7 Networking

Networking

Communication Strategy

To meet the challenges of today's global marketplace, Modicon communications systems offer customer driven solutions based on the integration of technologies, openness of systems, network architectures and connectivity.

A Communications/Networking system is like the neural network in the human body connecting the brain to the rest of the body. Our strategy is to use communication as the connecting web to link applications, computer platforms, PLCs and other automation devices within the control system and the enterprise.

For applications where control, process, and production information from multiple PLCs, PCs and other third party devices must be integrated quickly and safely, Schneider Automation provides networking solutions at several hierarchical levels to deliver rapid data communications throughout your application.

Choose your network – Schneider Automation technology will meet your requirements.

Modbus® – Since its introduction in 1979, Modbus has proven itself to be one of the most reliable, economical and popular industrial local area networks. Modbus is a master/slave network that permits a host computer to communicate to one of several PLCs to perform programming, data transfer, upload/download, and other host operations.

Modbus communications interfaces are available on Modicon PLCs, providing a ready and cost-effective way to handle remote data transfers and programming operations. Modbus may be used as the direct connection for a host device (such as a programming panel or data access panel) or as the interface to a multi-PLC master/slave network.

Modbus Plus – combines high speed, peer-to-peer communication and easy installation to simplify application implementation and reduce installation costs. This local area network allows host computers, PLCs and other data sources to communicate as peers throughout the plant via low-cost twisted-pair cable. Modbus Plus communicates at a one megabaud rate for fast access to process data. Typical applications include control networking, data acquisition, program upload/download, on-line remote programming, connection to operator interfaces, and host computer data collection.

Network devices include Modicon PLCs and several types of host computer products. For devices not directly supported on Modbus Plus, a Modbus Plus Bridge/Multiplexer provides four standard RS-232 ports.

Quantum Communications and Networking Solutions

For open, standards-based networking and fieldbus connectivity, the Modicon TSX Quantum Automation Series system provides multiple solutions.

- Modbus
- Modbus Plus
- Remote I/O
- TCP/IP Ethernet
- Sy/Max Ethernet
- MMS Ethernet
- Interbus-S
- LonWorks
- SERCOS

Every Quantum supported network offers a vast array of choices, connectivity and flexibility that provide an overall level of plant integration unsurpassed in the industry. You can use combinations of these networks to provide simple, high performance communication architectures which meet the tightly integrated needs of computer and controller connectivity. See the Quantum section of this Specifiers Guide for details.

Also in Chapter 7 – There are a number of networking-related products that enhance or expand the capabilities of Modbus and Modbus Plus described in this section, including:

- Bridging
- Redundancy
- Expansion
- Interfaces
- Fiber Optics
- PCMCIA Cards
- Terminal Block I/O

Modbus Communications: the *de facto* Industry Standard

How Modbus Works

In a Modbus network, all communications are initiated by a Modbus master device. The master device may be a host computer, operator interface, programming panel, Modicon PLC with ASCII communications capability or a PLC with XMIT capability. One or more PLCs can be connected to this master device.

Modbus Message Types

Modbus is not only cost-effective, it offers flexible communications. Communications may be a query/response, where the master addresses only one slave, or a broadcast/no response, where the master simultaneously addresses all the slaves.

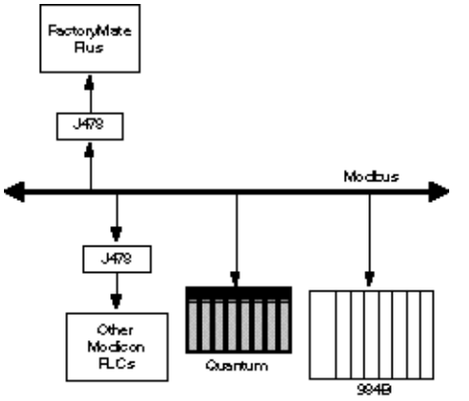
You can also choose the communication mode, that is the protocol or bit structure of the message transmissions (ASCII or RTU), as well as the baud rate and parity. RTU mode offers the highest performance due to the packing of data. It is typically used for local programming. ASCII mode, while offering lower performance than RTU mode, is easy to implement and is typically used for operator interface and host computer applications. Baud rate and parity are also selectable.

For certain PLCs, XMIT Block, a loadable function block, permits one of the COMM ports to become a Modbus Master, either temporarily or permanently. ASCII or RTU mode is a selectable option with the supported PLCs. This powerful functionality, when enabled, permits the PLC to report on exception. When XMIT is not active, the port defaults to slave mode, permitting the full set of function codes to be implemented.

Modbus Software

The Modbus protocol includes a set of software utilities for reading/writing registers or discrete inputs/outputs and for broadcasting data to all slave devices.

Modbus Network

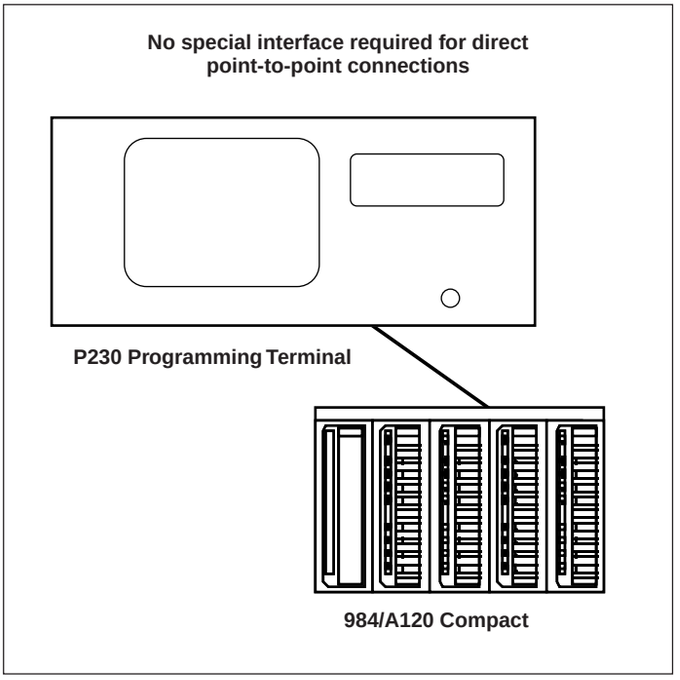


Modbus functions provide a full set of software utilities

Function Code	Command
01*	Read Coil (0x) Status
02*	Read Input (1x) Status
03*	Read Holding Register 4x) Status
04*	Read Input Register (3x) Status
05*	Force Output Coil (0x)
06*	Preset Single Register (4x)
07	Read Exception Status
08*	Loopback Diagnostic Test
11*	Fetch Communications Event Counter
12*	Fetch Communications Event Log
15*	Force Multiple Coils (0x)
16*	Preset Multiple Registers (4x)
17*	Report Slave ID
20*	Read general references, 6X references, multiple, but contiguous groups
21*	Write general references, 6X references, multiple, but contiguous groups

*Supported by XMIT Block

Modbus Topologies



Modbus Topologies

Modbus supports many topologies for control networks including point-to-point, multi-drop, and long-distance networks.

Direct, point-to-point connections

Configure a local system by directly connecting the master to the slave device up to distances of 50 feet via a standard RS-232C connection. This is a point-to-point configuration which is used typically for connectivity to a programming panel for local operator interface. For distances over 50 feet, a Modicon or other RS-232 compatible modem is required at each end. Speeds up to 19.2K baud are supported.

Multi-Drop Networks (Up to 15,000 feet)

For applications that require host connection to multiple PLCs, a multi-drop network is configured with a Modicon modem at each location. This configuration is typically used for remote programming panels, remote operator interfaces, or host computers.

The master and slave devices can be connected to a Modbus network with Modicon Modbus modems including the J478, J878, and S978 models. These models represent different packaging for use with different PLCs. The S978 is used with chassis-mount PLCs (984A, 984B, 984X), the J878 with slot mount PLCs (984-38x, -48x, -68x, and -78x Series), and the J478 for host computers and other PLCs.

Modicon modems support a network of up to 32 drops with maximum cable length of 15,000 feet, using twisted-pair technology. The network supports speeds of up to 19.2K baud.

Long Distance Networks

For long distance applications (greater than 15,000 feet), the PLCs may be connected using RS-232 modems over a common carrier (phone line, radio, microwave, etc.). This configuration is typically used for Remote Terminal Unit (RTU) applications.

In long distance applications, up to 247 nodes can be addressed from a single master device.

Modbus Hardware and Network Specifications

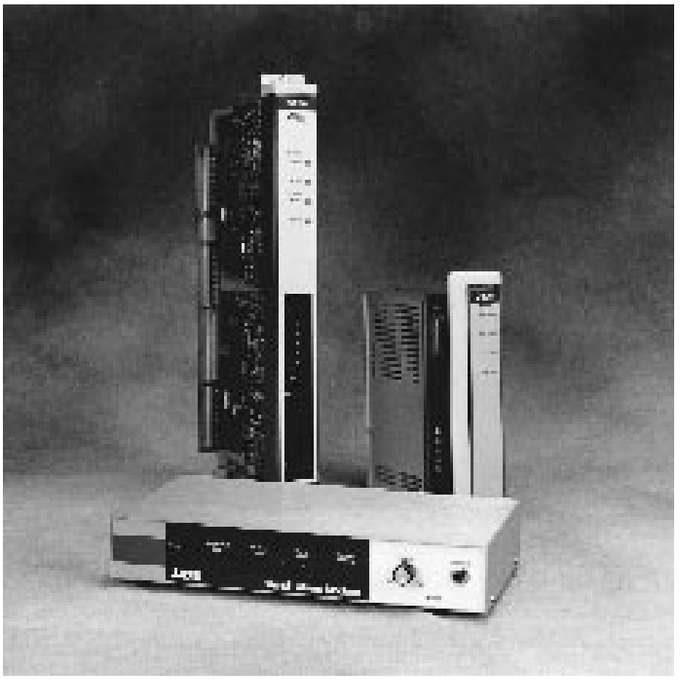
Modbus Modems and Cables

Three Modicon modems are available to create a Modbus point-to-point or multi-drop network using twisted pair topology. Each modem can be used as either a master or slave interface and differs only in their installation guidelines.

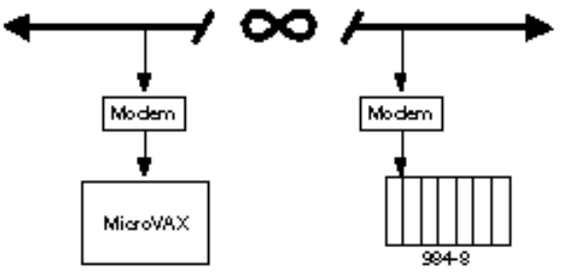
The S978 Dual Modbus Modem offers two independent Modbus modems on a single chassis-mount 984 option card (for use with a 984A, 984B, 984X). The S978 draws power directly from the 984 power supply.

Modicon Modbus Modems

Part Number	Description
AM-S978-000	Dual Modbus modem for 984A, 984B, 984X option slot
AS-J878-000	Single Modbus modem for 800 I/O slot
AS-J478-010	Single, standalone Modbus modem,115 Vac
AS-J478-020	Single, standalone Modbus modem, 230 Vac



Network distance capability essentially unlimited using common carrier technology (telephone, microwave, etc.)



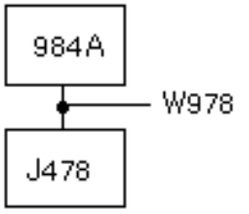
The J878 Modbus Modem offers a single modem housed in an 800 Series I/O module. You can install this modem in either a primary or secondary 800 Series housing. The J878 draws its power from the I/O power supply.

The J478 standalone modem can be used with any host computer or other Modbus device which cannot use either the S978 or J878 models. The J478 requires external 115 or 230 Vac for its power.

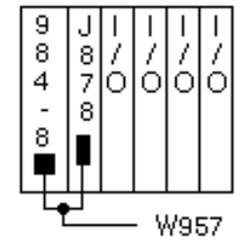
The selection chart on the previous page identifies Modicon Modbus modems.

Peripheral cables that facilitate connection between Modbus modems, programmers, and PLCs are also available. Refer to the selection chart below.

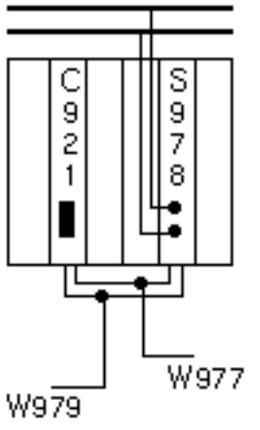
J478 to Chassis-Mount 984



J878 to Modbus Network



S978 to Chassis-Mount 984



Modicon Peripheral Cables

Part Number	Description
AS-W954-xxx	984-x8x Controller to J478
AS-W978-xxx	984 Controller to J478
AS-W957-xxx	984-x8x Controller to J878
AS-W979-xxx	984 Controller (front) to S978
AS-W977-xxx	984 Controller (bottom) to S978
AS-W955-xxx	984-x8x Controller to IBM-XT (25 pin D-connector)
AS-W956-xxx	984-x8x Controller to IBM-AT (9 pin D-connector)
AS-W958-xxx	9 to 25 pin adapter cable; connect W907 to 984-x8x

Modbus Network and Interface Technical Specifications

Modbus Network Characteristics

Mark Frequency	50 kHz
Space Frequency	80 kHz
Form of Modulation	Frequency Shift Keying (FSK)
Allowable Signal Attenuation	35 dB
Max. # Drops	32
Max Cable Length	15,000 feet
Transmission Media	Four conductor, full shielded twisted pair (Belden 8777)
Transmission Type	Asynchronous
Baud Rate	50 - 19,200 bits per second

J478 Modem

Power Requirements	50 mA @ 115 Vac ±15%, 49 to 61 Hz 30 mA @ 230 Vac ±15%, 49 to 61 Hz
Dimensions	13.07 x 2.75 x 6.4 in (322.1 x 69.85 x 162.6 mm)
Weight	3.25 lbs (1.48 kg)

S978 Modem

Power Requirements	P930/P933 Power Supply (200 mA)
Dimensions	Single Option Slot in 984A, 984B, 984X chassis
Weight	4.5 lbs (2 kg)

J878 Modem

Power Requirements	50 mA @ 115Vac ±15%, 49 to 61 Hz 984-x8x or 800 I/O Power Supply
Dimensions	Single slot in 800 Series I/O Housing
Weight	3.6 lbs (1.63 kg)

Modbus Plus: High Speed Networking At Its Best

Modbus Plus combines high-speed, peer-to-peer communications and simple implementation to reduce installation cost. This local area network allows host computers, PLCs, and other data sources to communicate as peers throughout the plant via low-cost, twisted-pair cable.

Modbus Plus communicates at a one megabaud communication rate for fast access to process data. Typical applications include control networking, data acquisition, program upload/download, remote programming, connection to operator interfaces, and host computer data collection.

Networked devices include Modicon PLCs and several types of host computer products. For devices not directly supported on Modbus Plus, a Modbus Plus Bridge/Multiplexer provides four standard RS-232 Modbus ports to interface Modbus-compatible devices to a Modbus Plus network. This eliminates the need to modify existing Modbus communication software drivers when upgrading to Modbus Plus. A wide range of industrial devices is available through the ModConnect Partners program. See Appendix and the ModConnect Partners Overview later in this chapter.

Why Modbus Plus is Right for You

Modbus Plus provides the following functionality on over 60,000 nodes currently installed.

Simple and Easy to Install – Modbus Plus' twisted pair cable and a Modicon connector system make installation a breeze. Modbus Plus networks utilizing fiber optic networks are also very easy to install.

Available Across the Modicon Family – Modbus Plus offers compatibility from the Compact and Quantum controllers to the wide variety of products offered through the ModConnect Partners Program.

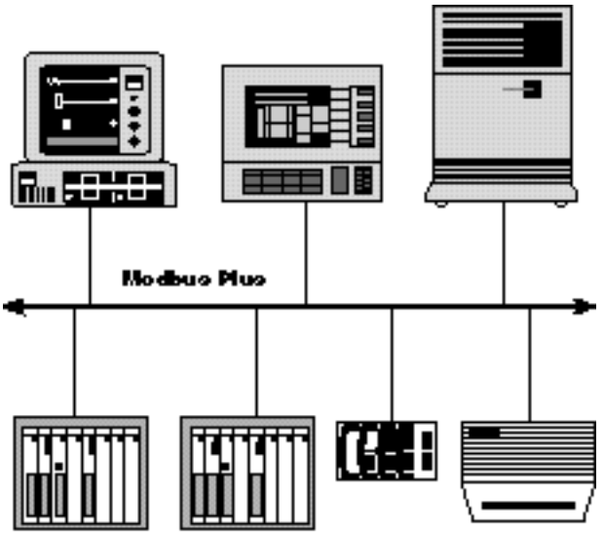
Communications are Easy to Program – Provides simple, easy to use example programs and diagnostics with host adapter drivers, and powerful MSTR blocks.

High Performance – Delivers over 20,000 registers/second in a predictable and deterministic manner.

Allows Flexible Network Architectures – Additional components like Bridges, Gateways and Repeaters allow flexible network design and implementation.

Easy to Maintain – Diagnostic programs and board-level LED health/fault indicators help troubleshoot your network around the clock.

Modbus Plus provides peer-to-peer connectivity between PLCs, operator interfaces, and host computers



Modbus Plus Network Architecture

Nodes on a Modbus Plus network function as peer members, gaining access to the network upon receipt of a token frame. When a node holds a token, it can initiate message transactions with selected destinations. You can address messages to any node on the network.

The standard Modbus Plus network supports up to 32 nodes at distances up to 1,500 feet. For applications that require more nodes or greater distance, a single RR85 Modbus Plus Repeater permits addressing of up to 64 nodes at distances up to 3,000 feet. Up to three repeaters are permitted to extend the network to 6,000 feet and 64 nodes.

For applications that require access to more than 64 nodes, the BP85 Modbus Plus Bridge Plus lets you link two Modbus Plus networks. This is especially useful when you want to link many small networks for optimal performance.

In applications where standard Modbus devices require access to Modbus Plus network data, a BM85 Modbus Plus Bridge/ Multiplexer offers four Modbus-compatible RS-232 serial ports that permit Modbus master or Modbus slave devices to link into a Modbus Plus network. The Modbus ports permit data exchange between Modbus devices as well as over the Modbus Plus network. Typical devices using the Bridge/ Multiplexer include programmers, operator interfaces, host computers, and other PLCs.

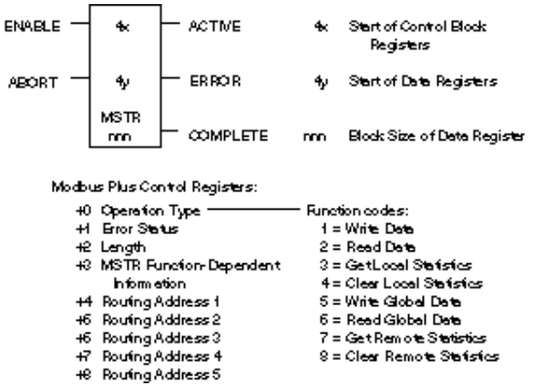
Modbus Plus Initiation

Modbus Plus is easy to implement. In a Modicon PLC, one function block, MSTR, initiates all Modbus Plus functions, including data transfers and network statistics. Modbus Plus data transfers include reading/writing data (up to 100 registers per operation) with any other PLC on the network. Modbus Plus also supports a global data mechanism that allows a device to broadcast data that is accessible to all other stations. Each controller can contribute 32 registers to the global data table.

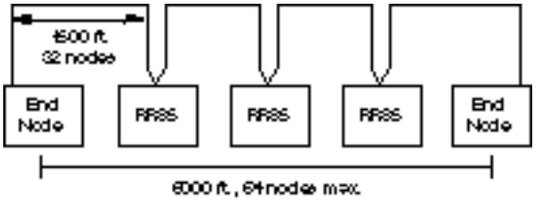
The MSTR block is used to initiate transactions over the Modbus Plus network. Up to four MSTR blocks can be active in any controller simultaneously. The balance of MSTR blocks will queue until any active block is complete.

Host computers implement Modbus Plus with NETBIOS-compatible software libraries which are callable from the host application program. The appropriate libraries are provided with each Modbus Plus host computer interface. All standard Modbus Plus functions are supported.

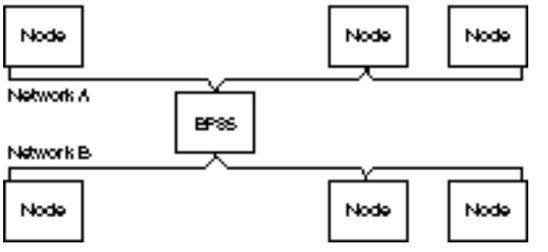
MB+ Initiation



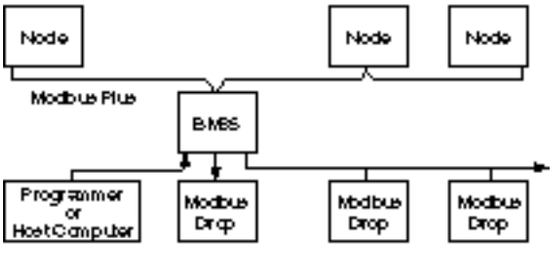
RR85 MB+ Repeaters extend MB+ networks up to 64 nodes and up to 6,000 feet



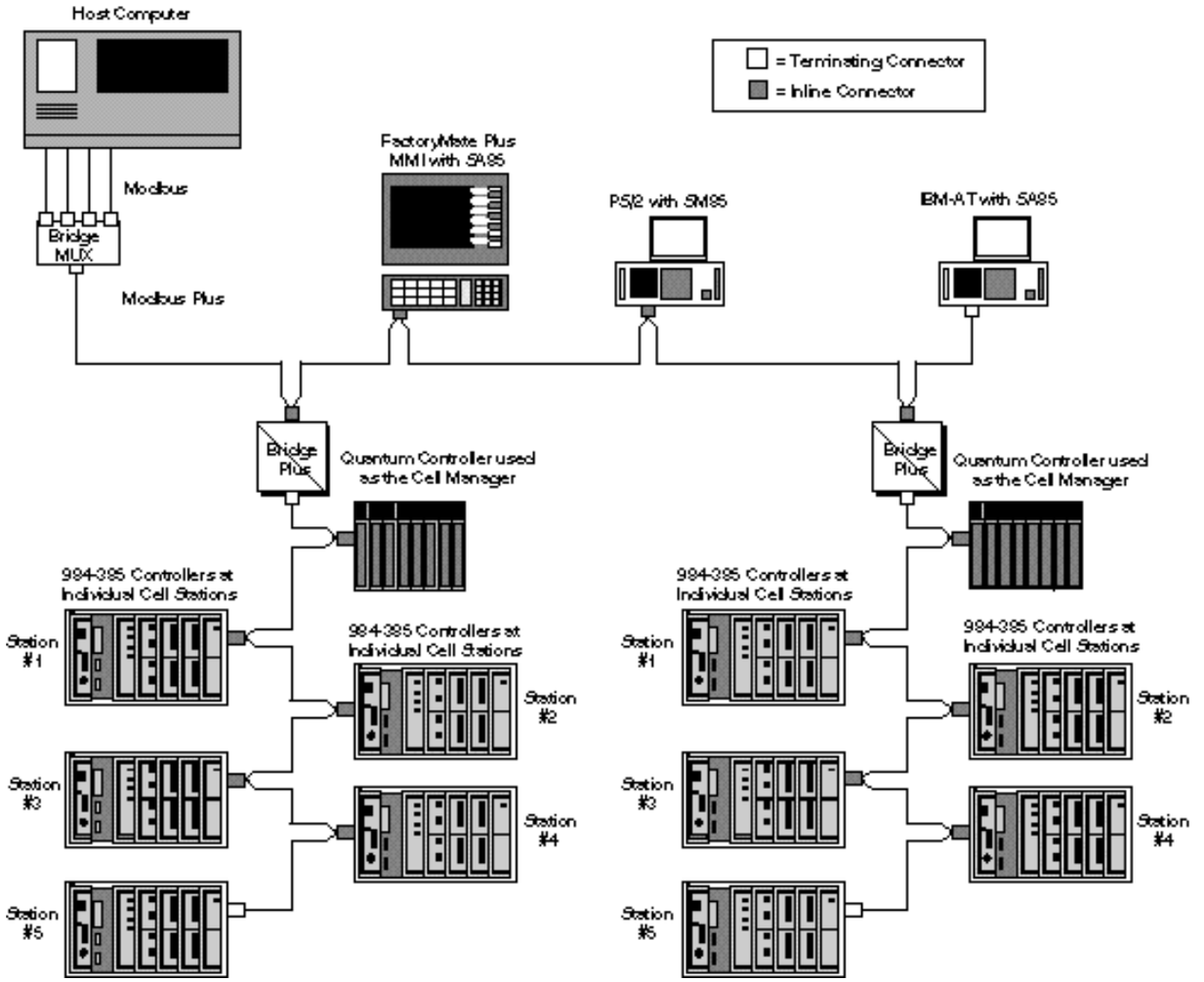
BP85 MB+ Bridge Plus links two MB+ Networks



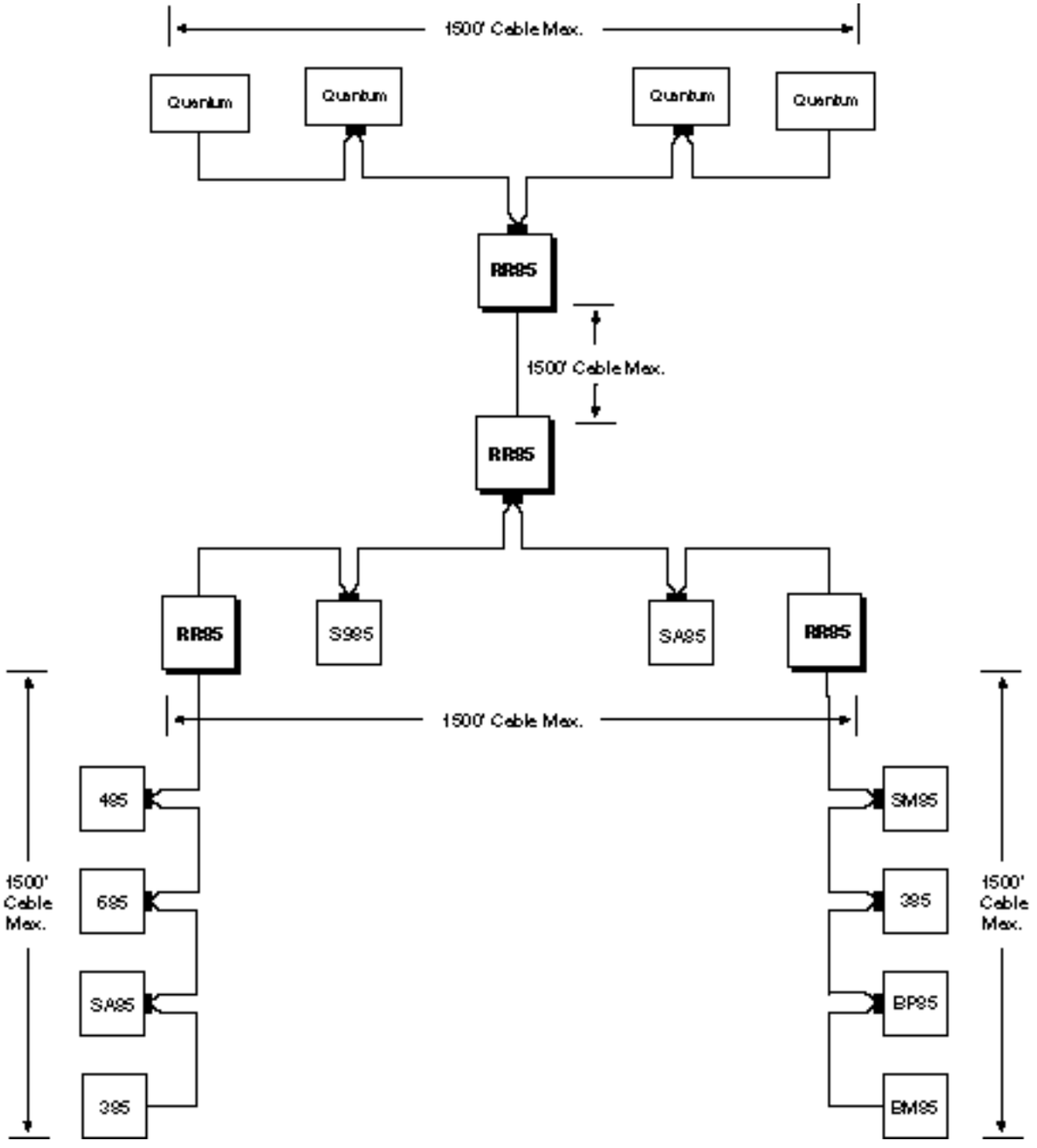
BM85 MB+ Bridge/Multiplexer connects standard Modbus-compatible devices (Master or Slave) into a Modbus Plus network



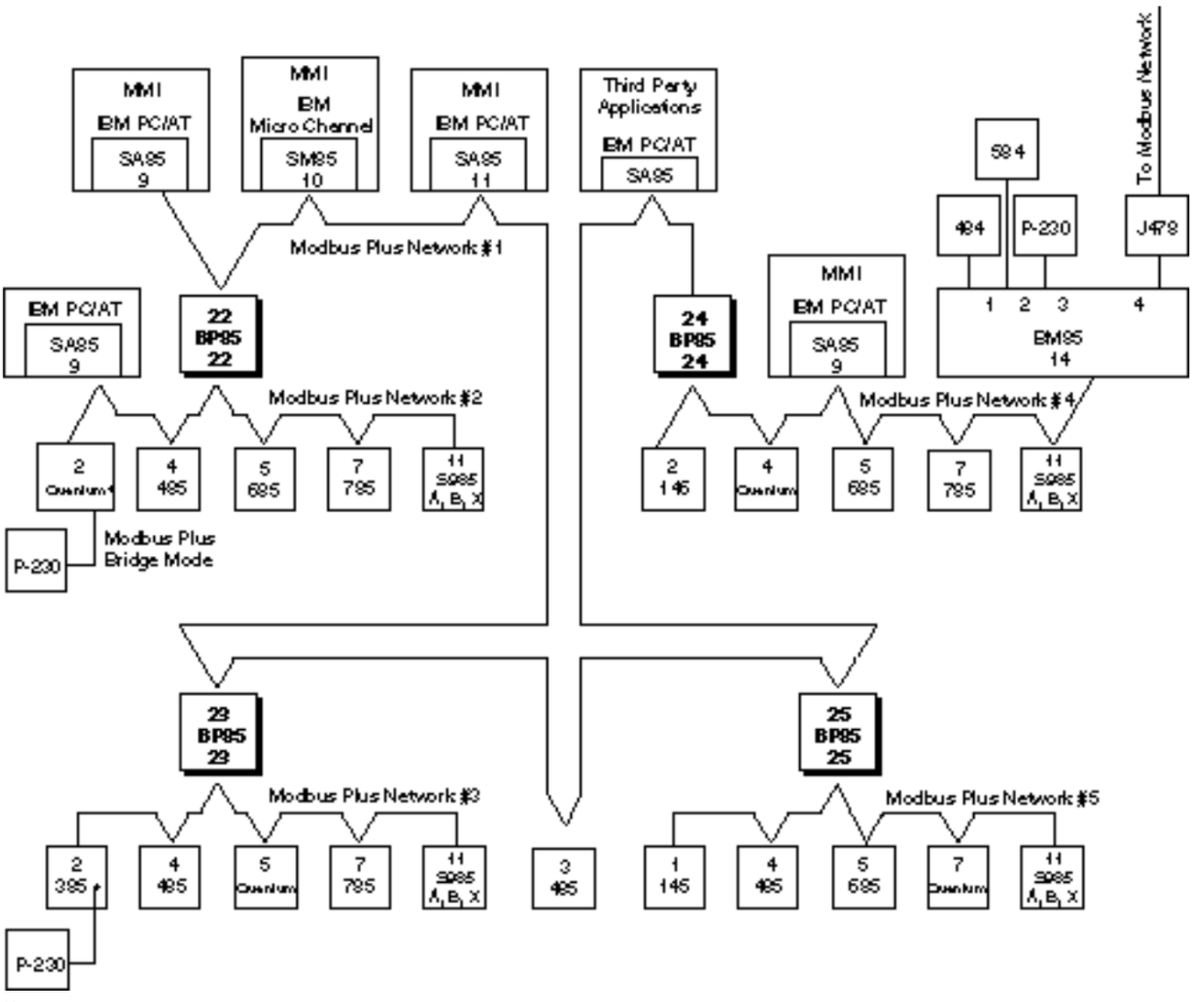
Modbus Plus in a Multi-Cell Manufacturing Area



Network Expansion with RR85



Network Bridging via BP85

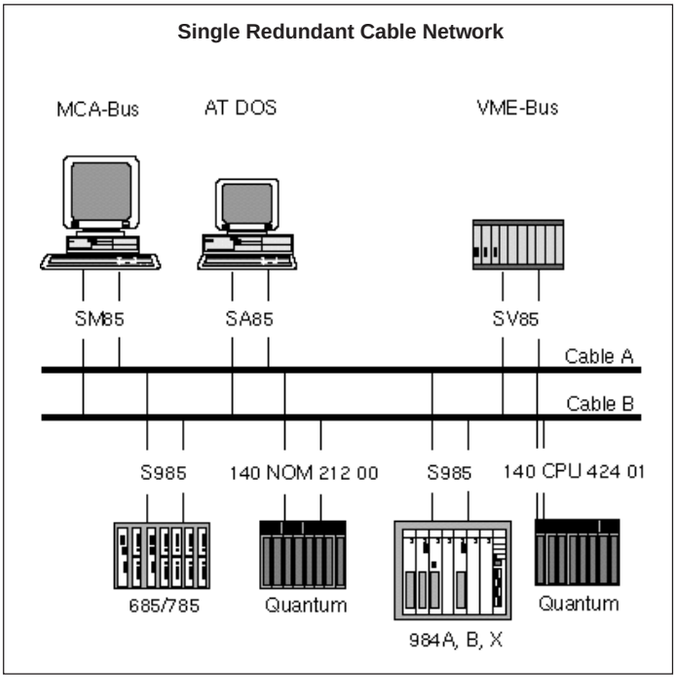


Notes:

Any device shown in this diagram can access all others shown. Note that Modbus devices follow the standard Modbus Master/Slave rules.

- Quantum Controller with address "7" on Modbus Plus Network #5 can access data from the Quantum address "4" on Modbus Plus Network #4 by using a MSTR block with explicit addresses 25,24,4,0,0.
- 485 Controller with address "4" on Modbus Plus Network #5 can access data from the 484 Controller connected to Modbus Plus Network #4 via the BM85 Bridge/MUX by using a MSTR block with explicit addresses 25,24,14,1,0.
- The P230 physically connected to 385 Controller address "2" on Modbus Plus Network #3 can "attach" to 785 Controller address "7" on the same network by performing "7 Attach", using explicit addressing internally converted to address 7,0,0,0,0.
- The P230 physically connected to Quantum Controller address "2" on Modbus Plus Network #2 can access data from 485 Controller address "3" on Modbus Plus Network #1 by performing 223 "Attach" using implicit addressing, internally converted to addresses 22,3,0,0,0.

Modbus Plus Redundancy



Standard application of Modbus Plus cable redundancy.

For applications that require high up time, Modbus Plus cable redundancy is offered on a variety of network components and add-in options. Redundant cable capability permits Modbus Plus to communicate over two independent cables, testing the integrity of both cables with every message. Should one cable fail, the system automatically switches to the other and the faulty cable is flagged in statistics. That way, should a cable be brought out of service for any reason, the network keeps running using the alternate path. Using recommended procedures, a faulty cable can be tested, debugged and brought back to service while the alternate cable continues to run. Modbus Plus cable redundancy is offered on the following Modicon products:

Host Based Products	
AM-SA85-002	IBM PC/AT Adapter
AM-SM85-002	IBM Micro Channel Adapter
AM-SV85-002	VME Bus Adapter
AM-0984-AT2	AT 984, 2K x 16K Host Based Controller
AM-0984-AT4	AT 984, 32K x 32K Host Based Controller
PLC Products	
140 CPU 424 02	Quantum CPU
140 NOM 212 00	Quantum Network Adapter
AM-S985-800	984-685/785 Network Adapter
AM-S985-0X2	984 A, B or X Network Adapter
Network Components	
NW-BP85-002	Bridge Plus
NW-BM85C002	Bridge/MUX
NW-BM85C002C	Bridge/MUX with conformal coating
NW-BM85S232	Programmable Bridge/MUX, four RS-232 Ports
NW-BM85S485	Programmable Bridge/MUX, four RS-485 Ports

Modbus Plus Enhancements

PEER COP

PEER COP permits PLCs to perform automatic data exchanges with other PLCs. Similar to the Modicon Traffic Cop, PEER COP takes data from a reference area within a “source” PLC and places it in a particular reference area of a “destination” PLC over the Modbus Plus network. It performs this operation the the exact same way every token rotation. PEER COP has two variants: one treats global data in a different way; the other, uses a new broadcast mode to send a single message as large as 500 registers. The former permits global data input at a “destination” PLC to be indexed to as many as 8 different locations in state RAM, any single reference type at the source, or to any number of output reference types at the destination (excluding 6Xs). The large broadcast message of the latter contains sub addresses for any number of destinations, from any single reference type to any single output reference type (again, excluding 6Xs). PEER COP is supported on the “E” PLCs; PC-E984-785, PC-E984-685, PC-E984-485, PC-E984-385 and PC-A984-145, on AM-S985-800 Adapters used in "E" PLCs, on Quantum sytems and on 8 and 16 Element Operator Panel HMIs.

Network Write Protection

To minimize the possibility of a programmer inadvertently writing from a source PLC to an area which is reserved for internal operations in a destination PLC, a write protect function is provided in the “E” controllers. With Modsoft 1.2, or higher, it is possible, over the network, to set up an “enabled” area to access 0X and 4X references from across the network. The flip side of this feature is that, whatever is not “enabled” becomes disabled from network access. This fencing option provides high security against programming mistakes.

EMBP Gateway

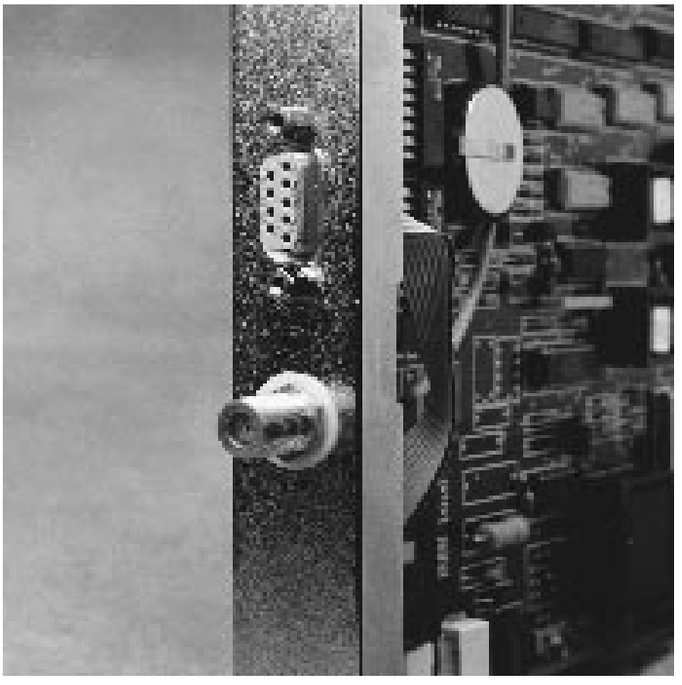
The SW-EMBP-000 Ethernet to Modbus Plus Gateway permits devices on either a DECNET or TCP/IP LAN to access Modbus Plus devices in a client/server mode. On all software products capable of running on an IBM PC/AT, it uses the facilities of Digital’s Pathworks internally, and requires the user to provide Pathworks for the client nodes. Modicon Modcom III and Modsoft are fully supported by the Gateway.

BM85S Programmable Modbus Plus Bridge/MUX

To permit third party device connectivity to Modbus Plus, Schneider Automation offers two versions of programmable Bridge/MUXs. One Bridge/MUX has four RS-232 ports, the other with four RS-485 ports. User memory space is equal to 240K of flash RAM.

A separate Developers Support Package permits VARs and systems integrators to develop application programs that provide protocol translation for third party products to interface with the Modbus Plus network.

Modbus Plus Hardware and Technical Specifications



Many Modicon PLC's come standard with a Modbus Plus port. These include the 984-145, 984-385, 984-485, 984-685, and 984-785. Chassis-mount controllers (984A, 984B, 984X) can connect to the Modbus Plus network with the S985 Option Processor plugged into any available option slot. The S985 and the S985-800 (for slot mount controllers) have a Modbus port with bridge mode capability into Modbus Plus.

To improve performance in data collection and remote programming applications, Modbus Plus interfaces are available for most computer platforms. Interfaces are available for connectivity using ISA architecture, or PCMCIA type II or lll. Many software packages make direct use of the Modbus Plus interface. Modicon-supplied libraries permit most software packages to access the performance of Modbus Plus.

Modbus Plus Network Interfaces and Accessories

Model Number	Description
PC-A984-xx5	Compact controllers with built in Modbus port
140-CPU- XYZ-0N	Quantum CPUs
140-NOM-21X-00	Quantum Network Option Modules
AM-S985-800	Modbus Plus Network Adapter, 685/785 Controllers*
AM-S985-002	Modbus Plus 984X*
AM-S985-012	Modbus Plus 984A with S901 I/O Processor*
AM-S985-022	Modbus Plus 984A with S908 I/O Processor*
AM-S985-032	Modbus Plus 984B with S901 I/O Processor*
AM-S985-042	Modbus Plus 984B with S908 I/O Processor*
AM-SA85-000	IBM XT/AT Network Adapter
AM-SA85-002	IBM XT/AT Network Adapter*
416-NHM-212-00	PCMCIA II Network Adapter
416-NHM-212-03	PCMCIA III Network Adapter
AM-SM85-002	IBM Micro Channel Interface Board*
AM-SV85-002	VME Bus Network Adapter*
NW-RR85-001	Modbus Plus Repeater
NW-BP85-002	Modbus Plus Bridge Plus*
NW-BP85-D002	Modbus Plus Bridge Plus for Utilities
NW-BM85-000	Modbus Plus Bridge/Mux
NW-BM85C002	Modbus Plus Bridge/Mux*
NW-BM85C002C	Modbus Plus Bridge/Mux with conformal coating
NW-BM85D002	Modbus Plus Bridge/Mux for Utilities
NW-BM85S232	Programmable Bridge/Mux W/4 RS-232 Ports*
NW-BM85D002	Programmable Bridge/Mux for Utilities
NW-BM85S485	Programmable Bridge/Mux W/4RS-485 Ports*
SR-BM85-S00	BM85 Developers Support Package
AS-MBKT-085	Modbus Plus Inline Connector (1 per pkg)
AS-MBKT-185	Modbus Plus Terminator Connectors (2 per pkg)
AS-MBPL-001	Connector Assembly Tool
490NAA27101	100 ft. roll, Modbus Plus cable (Belden 9841)
490NAA27102	500 ft. roll, Modbus Plus cable (Belden 9841)
490NAA27103	1,000 ft. roll, Modbus Plus cable (Belden 9841)
490NAA27104	1500 ft. roll, Modbus Plus cable (Belden 9841)
490NAA27106	5,000 ft. roll, Modbus Plus cable (Belden 9841)
490NAA21302	Modbus Plus Super Cable, 500 foot roll, FT-4, FT-6, Plenum rated
990NAD21110	Drop cable, 8ft
990NAD21130	Drop cable, 20ft
990NAD23000	Tap
AM-0984-AT2	PLC-984 on an IBM PC/AT board 2K x 16K*
AM-0984-AT4	PLC-984 on an IBM PC/AT board, 32K x 16K*
AM-0984-MCO	PLC-984 on an IBM PS/2 board
490NRP25400	Modbus Plus Fiber Optic Repeater, Line/Drop
NW-FR85D200	Modbus Plus Fiber Optic Repeater for Utilities
490NRP25300	Modbus Plus Fiber Optic Repeater, Point-to-point
490NRP95400	Modbus Plus Fiber Optic Repeater, Line/Drop
NW-FR89D200	S908* Bus Fiber Optic Repeater for Utilities
SW-EMBP-000	Ethernet to Modbus Plus Gateway
352SMD493nn	Modlink DDE drivers for Windows®

*Modbus Plus Redundant Cable

Technical Specifications for Modbus Plus Network Products

Modbus Plus Network Characteristics

Speed	1 Megabit per Second
Distance	1,500 feet (500m) per trunk 6,000 feet (2000m) with repeaters
Number of Nodes	32 per trunk without repeaters 64 per trunk with repeaters
Medium	Single twisted shielded pair, Modicon 490NAA271nn Series Cable or 490 NAA 213 02 Super Cable
Error Checking	CRC16
Medium Access	Token bus
Optional Documentation	GM-MBPL-001 Modbus Plus Network Planning and Implementation Guide GM-0984-SYS 984 Programmable Controller Systems Manual

S985 Modbus Plus Interface for 685/785 Controllers

Part Number(s)	***AM-S985-800 includes:** S985 Board GM-S985-001 Installation and Programming Manual
Connectors	One Modbus Plus 9-pin D-connector One Modbus 9-pin D-connector
Switches	DIP for MB Plus address (1-64)
LED	Modbus Plus Active (Green) Modbus Active (Green)
Power Requirements	5 Vdc, 4 watts
Dimensions	1 option slot
Weight	4.0 lbs (1.8 kg)

S985 Modbus Plus Interface for Chassis-Mount PLCs

Part Number(s)	***AM-S985-0x2 includes:** S985 board Executive Cartridge for 984 Controller GM-S985-001 Installation and Programming Manual SW-AP9X-MBP MSTR Block Loadable
Connectors	One Modbus Plus 9-pin D-connector, One Modbus 9-pin D-connector
Switches	DIP for MB Plus address (1-64)
LEDs	Modbus Plus Active (Green) Modbus Active (Green)
Power Requirements	P930/P933 Power Supply
Dimensions	1 option slot in 984A, 984B, 984X
Weight	4.0 lbs (1.8 kg)

SA85 Modbus Plus Interface for IBM XT/AT

Part Number(s)	**AM-SA85-000 (single cable)** ***AM-SA85-002 (Redundant cable)** **Includes:** SA85 Board NETBIOS Drivers for DOS and OS/2 MBPSTAT Diagnostic Software GM-HBDS-001 IBM Host Based Devices Users Guide GM-MBPL-001 Modbus Plus Network Planning and Installation Guide
Connectors	One Modbus Plus 9-pin D-connector
Switches	DIP for MB Plus address (1-64) DIP for Memory Page
LEDs	Modbus Plus Active (Green) * Comm Error Channel A * Comm Error Channel B
Power Requirements	IBM XT/AT Power Supply
Dimensions	XT-bus Half Slot Card 4.2 x 5.2 in (107 x 132 mm)
Weight	3.0 lbs (1.4 kg)

NHM Modbus Plus PCMCIA II Card

Part Number	**416 NHM 212 00**
Description	Modbus Plus Network Adapter for IBM Compatible Notebook Computers, other PCMCIA Equipped Platforms
Deliverables	416 NMH 212 00 Consisting of:
Hardware	Modbus Plus Network Adapter (Card Information Services, Tuples, not supported) (Interrupts not supported)
Software	MBP Host DOS Driver with Support for Windows 3.1 (Card_Insertion, Card_Removal events not supported) MBPSTAT Diagnostic Tool NETLIB.C Development Library
Documentation	Users manual
Connectors	One Modbus Plus 9-pin D-connector One 68 pin host connector per PCMCIA standard
Selectable Options (Set in Software)	Modbus Plus Node Address PCMCIA Slot Address Memory Base Address
Indicators (LEDs)	Modbus Plus Active, Green Standard Modbus Plus Flash Codes
Environmental	
Temperature	0 to 55°C, operating -20 to + 65°C, storage
Humidity	0-95%, non-condensing
Physical Characteristics	
Single Piece molded assembly consisting of:	
Host adapter	PCMCIA type ll form factor 3.37" long X 2.125" wide X 0.197" thick
Outrigger	3.37" long X 2.125" wide X 0.6" thick
Integral Cable	6.0" long X 1.25" wide X 0.030" thick
Power Requirements	500 mA @ 5.0 Vdc

NHM Modbus Plus PCMCIA III Card

Part Number	**416 NHM 212 03**
Description	Modbus Plus Network Adapter for IBM Compatible Notebook Computers, other PCMCIA Equipped Platforms
Deliverables	416 NMH 212 03 Consisting of:
Hardware	Modbus Plus Network Adapter (Card Information Services, Tuples, not supported) (Interrupts not supported)
Software	MBP Host DOS Driver with Support for Windows 3.1 (Card_Insertion, Card_Removal events not supported) MBPSTAT Diagnostic Tool NETLIB.C Development Library
Documentation	Users manual
Connectors	One Modbus Plus 9-pin D-connector One 68 pin host connector per PCMCIA standard
Selectable Options (Set in Software)	Modbus Plus Node Address PCMCIA Slot Address Memory Base Address
Indicators (LEDs)	Modbus Plus Active, Green Standard Modbus Plus Flash Codes
Environmental	
Temperature	0 to 55°C, operating -20 to + 65°C, storage
Humidity	0-95%, non-condensing
Physical Characteristics	
Single Piece metal assembly consisting of:	
Host adapter	PCMCIA type lll form factor 4.25" long X 2.126" wide X 0.400" thick
Power Requirements	500 mA @ 5.0 Vdc

Technical Specifications for Modbus Plus Network Products

SM85 Modbus Plus Interface for IBM Micro Channel

Part Number(s)	***AM-SM85-002 includes:**
	SM85 Board
	NETBIOS Drivers for DOS and OS/2
	MBPSTAT Diagnostic Software
	GM-HBDS-001 IBM Host Based Devices Users Guide
	GM-MBPL-001 Modbus Plus Network Planning and InstallationGuide
Connectors	One Modbus Plus 9-pin D-connector
Switches	DIP for MB Plus address (1-64)
LEDs	None
Power Requirements	IBM Micro Channel Power Supply
Dimensions	MCA-Bus Half Slot Card 3.475 x 11.5 in. (88 x 292mm
Weight	3.0 lbs (1.4 kg)

NRP Fiber Optic Repeaters

Part Number:
- 490NRP 254 00 (Modbus Plus Line/Drop)
- 490NRP 253 00 (Modbus Plus Point-to-Point)
- 490 NRP 954 00 (S908 Bus, Line/Drop)

Description: Modbus Plus Fiber Optic Repeater

Deliverables:
- 490 NRP n5nnn Repeater
- GI-FR85-001 User Manual

Environmental Characteristics:
- Temperature:
  - 0 to 60°C (Operating)
  - 40 to 80°C (Storage)
- Humidity:
  - 0 to 95% (Non-condensing)

Physical Characteristics: (Ref. Fig 3)

Height	2.585 in.
Width	14.080 in.
Depth	8.30 in.
Weight	
(Net)	5.5 lbs.
(Shipping)	6.5 lbs.

Indicators:
Power – Green, Steady
Wireside Active – Amber, Steady
Fiberside Active – Amber, Steady

Power: 110/220 VC ±15% Plug Selectable, surge protected
24 Vdc ±15% (Unprotected)
8.0 Watts

Data Rate:

Modbus Plus	1.0MBaud
S908 Bus	1.544 MBaud

Distance (Wire):

S908 Bus	Full 35 dB
Modbus Plus	1.5 K Ft., w/o Repeaters 6.0 K Ft., w/ Repeaters

Optical:

Wavelength	820 nm
Connectors:	AT&T type ST

Optical Budget:

50/125µ	-6.5 dB
62.5/125µ	-11.0 dB
10/140µ	-16.5 dB

Optical Launch Power:

50/125µ	-12.8 to - 19.8 dBm
62.5/125µ	-10.0 to - 16.0 dBm
100/140µ	-3.5 to - 10.5 dBm

Receiver Sensitivity: -30 dBm
Dymanic Range: 20 dB

Distance vs Number of Repeaters (Fiber):
See Chart on page 27.

Pulse Width Distortion Tolerance:

Modbus Plus	200 ns
S908 Bus	130 ns

Contributions:

Wireside S908 & MB+	40 ns
Fiber	3.0 ns/km*
Repeaters	10.0 ns/Box

*62.5 µ Fiber only

SV85 Modbus Plus Interface for VME Bus Platform

Part Number(s)	*AM-SV85-002
Prerequisites	Qualification as a ModConnect Partner purchase which provides: Technology package Development and support environment
Connectors	5 9-pin D-connectors, 3 for RS-232 ports, 2 for redundant Modbus Plus ports
Switches	DIP for Modbus Plus address
LEDs	1, green, Modbus Plus Active, standard MB+ flash codes 2, red, Comm Error, 1 each, MB+ Cable A & Cable B
Power Requirements	+5.0 Vdc, 1.0 Amp, Max
Dimensions	Single slot width, 6U form factor
Weight	3.0 lbs (1.4 kg)

BP85 Modbus Plus Bridge Plus

Part Number(s)	*NW-BP85-002 includes: Modbus Plus Bridge Plus GM-MBPL-001 Modbus Plus Network Planning and Installation Guide
Connectors	Modbus Plus 9-pin D-connectors (4)
Switches	Two DIPs for MB+ address (1-64)
LEDs	Power (Green) Comm error (Red) (4) Port 1, Channel A Port 1, Channel B Port 2, Channel A Port 2, Channel B Modbus Plus Active (Green) (2)
Power Requirements	115/230 Vac ±15%, 10 watts 24 Vdc ±15%, 8 watts
Dimensions	2.5 x 14.1 x 8.3 in (6.4 x 358 x 211 mm)
Weight	8.0 lbs (3.6 kg)

RR85 Modbus Plus Repeater

Part Number	NW-RR85-001 includes: Modbus Plus Repeater
Connectors	Two Modbus Plus 9-pin D-connector
Switches	None
LEDs	Power (Green) Modbus Plus Active (Green)
Power Requirements	115/230 Vac
Dimensions	2.5 x 14.1 x 8.3 in (64 x 358 x 211 mm)
Weight	9.0 lbs. (4.1 kg)

Modlink DDE Software

Part Number	352SMD49300 Modlink DDE driver for Windows
Part Number	352SMD49310 Modlink Lite Software
Part Number	352SMD49320 Modlink Trial Software

Technical Specifications for
Modbus Plus Network Products, and Interfaces

BM85 Modbus Plus Bridge/MUX

Part Number(s)	*NW-BM85C002 NW-BM85-000 includes: Modbus Plus/Modbus Bridge Multiplexer GI-BM85-001 Bridge/MUX Installation Guide
Connectors	One Modbus Plus 9-pin D-connector Four Modbus 9-pin D-connector
Switches	DIP for MB Plus address (1-64)
Modbus Port Options	Port (1-4) Type - Master/Slave Device Address (1-247) Baud Rate (300 - 19200) Stop Bits (1,2) Parity (Odd, Even, No) Mode (RTU, ASCII) Priority (1-4) Link timeout (1 - 3000) Modem Booster (Y,N)
LEDs	Power (Green) Ready (Amber) (only-000 version) Modbus Plus Active (Green) * Comm Error, Channel A * Comm Error, Channel B Modbus Active (four green)
Power Requirements	115/230 Vac ±15% 10 watts
Dimensions	2.5 x 14.1 x 8.3 in (64 x 358 x 211 mm)
Weight	12.0 lbs (5.5 kg)

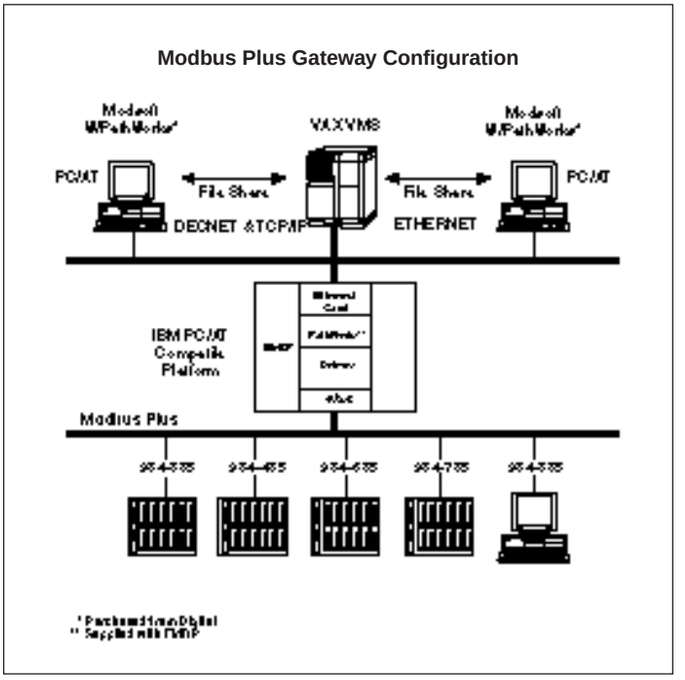
BM85 Programmable Modbus Plus Bridge/MUX

Part Numbers	*NW-BM85S232 *NW-BM85S485 includes: Programmable MB+ Bridge/MUX GI-BM85-001 Modbus Plus Bridge/MUX Installation Guide SR-BM85-S00 Developer's Support Package (purchased separately)
Connectors	Modbus Plus 9-pin D-connectors (2) Serial Ports 9-pin D-connectors (4)
Switches	One DIP for MB+ address (1-64)
Port Options	BM85S232, four RS-232 ports BM85S485, four RS-485 ports Communication protocol by user
LEDs	Power (Green) Modbus Plus Active (Green) Comm Error, MB+ Channel A (Red) Comm Error, MB+ Channel B (Red) Serial Port Activity, user programmed (4) (Green)
Power Requirements	115/230 Vac ±15%, 10 watts 24 Vdc ±15%, 8 watts
Dimensions	2.5 x 14.1 x 8.3 in (64 x 358 x 211 mm)
Weight	12.0 lbs (5.5 kg)

* Modbus Plus Redundant Cable

EMBP Gateway

For Modbus Plus users, the Modconnect Ethernet Gateway provides a connection between Modbus Plus and Ethernet. This gateway provides instant connectivity between devices on Ethernet using TCP/IP or DECnet to Modbus Plus-equipped devices such as Modicon PLCs. Applications include on-line programming, program upload/download (LRV) data acquisition and control, HMI and other host functions.



Modicon Bx85D00x and FR8xD200 Series 19" Rackmount 125 Vdc Bridge Muxes

The Bx85D00x and FR8xD200 Series Muxes are 19" rackmountable 125 Vdc-powered versions of the standard Modicon Bridge Muxes and Fiber Optic Repeater. Programming, operation, and networking of these units are identical to that of the standard products.

The Bx85D00x and FR8xD200 Series Muxes are designed primarily for 125 Vdc substation applications such as RTU protocol conversion, protective relay interface, data storage, and Sequence of Events Recording (SER). The following table provides a quick reference to the components and application of these products.

Utility Product	Power Supply	Standard Product	Box	Application
NWBM85D002	125Vdc/24 Vdc	NWBM85000	19" rackmountable	Modbus Plus to 4 RS232 Ports
NWBM85D008	125Vdc/24 Vdc	NWBM85C002	19" rackmountable	Modbus to Modbus Plus Dual Cable Bridge
NWBP85D002	125Vdc/24 Vdc	NWBP85002	19" rackmountable	Modbus to Modbus Plus Bridge
NWFR85D200	125Vdc/24 Vdc	490NRP25400	19" rackmountable	Modbus Plus Line Drop Fiber Optic Modem
NWFR89D200	125Vdc/24 Vdc	490NRP95400	19" rackmountable	Remote I/O Fiber Optic Modem

Electromagnetic Susceptibility

Specification	Value	Modicon World Standard	Equivalent IEEE/ ANSI Standard
Radiated	27…500 MHz, 10 V/m	IEC 801–3, level 3	C37.90.2, 1987
Surge withstand – Fast Transient*	± 2kV* 1kV on I/O	IEC 801–4, level 3	C37.90.1.1989 (Section 2.3)
Surge Transients	2kV	IEC 801–5, level 3	
Electrostatic Discharge	8kV, ten discharge	IEC 801–2, level 3	
Surge Withstand – Oscillatory Wave	2.5kV	IEEE 472	C37.90.1, 1999

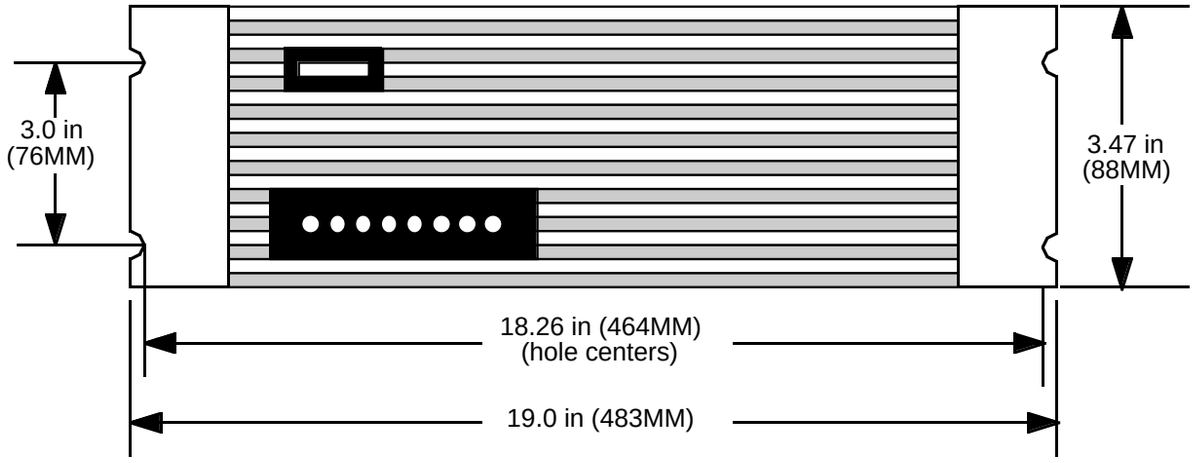
125 Vdc Power Supply Specifications

Input Ratings

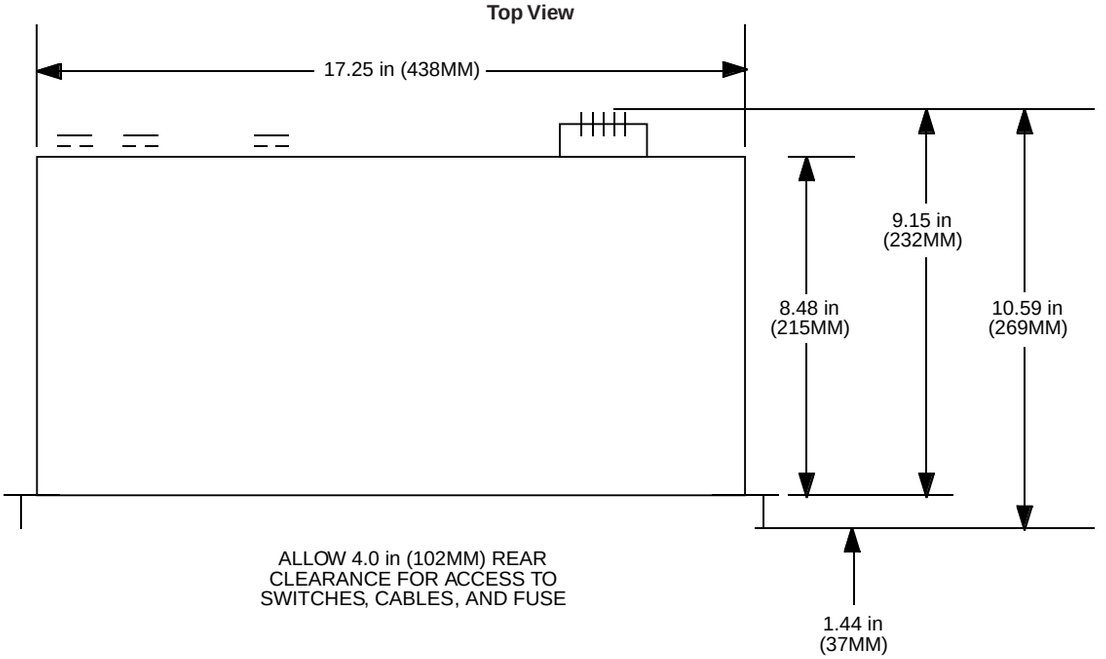
Input Voltage Rating	105–140 Vdc
Ground Leakage	1 mA @ 140 Vdc
Input Current	.41 mA @ 125 Vdc
Inrush Current	6 A (typical) @ 125 Vdc

Mounting Template
All Five 125 Vdc Bridge Muxes share the same mounting template

Front View



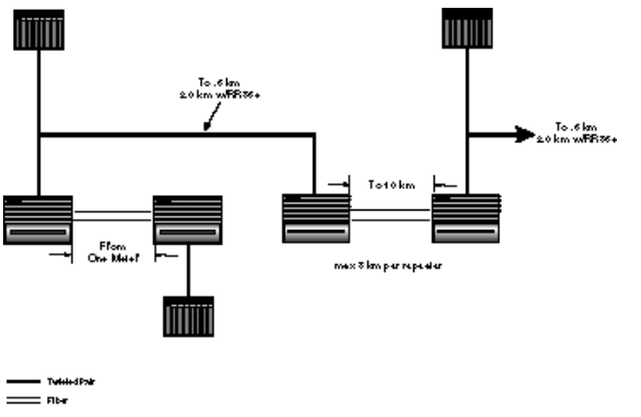
Top View



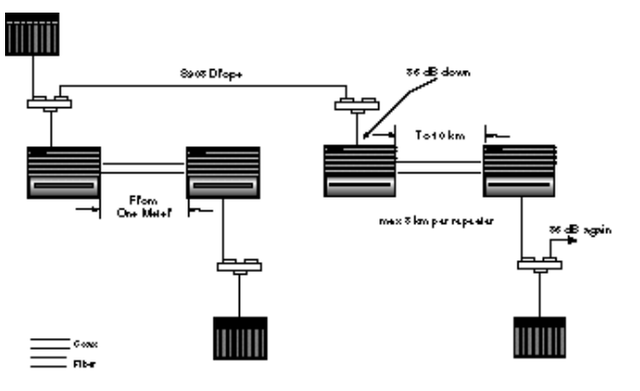
Fiber Optics

To permit networks of lengths much greater than those possible with copper wire, several fiber optic repeaters are available that permit Modbus Plus or S908 bus devices to communicate up to 3 km over 62.5/125 micron fiber optic cable segments. Total end-to-end distance over fiber is 10 km while still supporting full dynamic range of the wire networks to which they interface.

Modbus Plus Fiber Optic Configuration



S908 Bus Fiber Optic Configuration



Fiber Optic Repeaters

The Modicon Fiber Optic Repeater Series permits Modicon wire-based networks (S908), Distributed I/O, (Bus and Modbus Plus) to interface with fiber optic media. Permitting communication over very long distances, the Modicon Fiber Optic Repeaters (490NRP25300, 490NRP25400 and 490NRP95400) provide noise immunity in high RFI/EMI environments, electrical isolation and use of a wide variety of medium component options. All three Modicon Fiber Optic Repeaters act as an amplifier, offer users completely transparent operation and offer the plug and play simplicity of Modbus Plus. Fiber cables and components are available for use in direct sunlight, direct burial, corrosive environments, plenum and riser ratings.

The Modicon 253 Repeater allows point-to-point connection for two segments of a Modbus Plus network in a busy industrial environment. The 254 and 954 extend the length of the fiber optic in a “BUS” configuration.

The Modicon 490NRP Series of Fiber Optic Repeaters are housed for harsh industrial environments and are fitted for wall or desktop mounting.

Features and Benefits

- Supports full dynamic range of wireside
  - Modbus Plus: to 1.5K ft. and 32 nodes without repeaters to 6.0K ft. and 64 nodes with repeaters
  - S908 Bus: full 35 dB
- Supports full dynamic range of fiberside
  - Fiber segments as short as 1 meter, and as long as 3km without use of attenuators, special selection of range or need for adjustment
- Fiber optic properties
  - Very long distances; to 3km per segment, 12km total
  - Eliminates RFI/EMI emissions
  - Eliminates RFI/EMI susceptibility
  - Eliminates ground offsets
  - Provides intrinsic safety
  - Commercially supported by very large and growing infrastructure
- Tools, equipment and supplies available
- Technology for design, installation and maintenance available
- Modicon product for Modicon application
  - 100% compatibility guaranteed
  - One-stop shopping
  - Modicon support, 24 hours a day, anywhere in the world
- 110/220 Vac and 24 Vdc built in
  - US and European utilities battery operation supported

Use of Fiber Optic Repeaters in a BUS configuration lets you chain a number of repeaters to extend the fiber optic link, thus increasing the distance between the segments or nodes of the network. In a Modbus Plus Network, 490NRP25400 and 490NRP25300 Repeaters are used. Remote I/O network user 490NRP95400 Repeaters are used.

The use of Fiber Optic Repeaters and Optical Star Couplers (passive or active) can provide a high level of flexibility to the fiber optic medium, and hence to Modbus Plus and remote I/O Networks. Additional repeaters can be connected to either an electrical link or a fiber optic link in order to extend communication between Modbus Plus or Remote I/O electrical links.

If a Passive Star Coupler is used (1) the number of Repeaters and the length of each segment of fiber optic cable must be calculated separately, and (2) use of 100 μm cable is required because of its higher available optical power.

Specifications

Part Number
490NRP25400 (Modbus Plus Line/Drop)
490NRP25300 (Modbus Plus Point-to-Point)
490NRP95400 (S908 Bus, Line/Drop)

Description Modbus Plus Fiber Optic Repeater

Deliverables
490NRPn5nnn Repeater
GI-FR85-001 User Manual

Environmental Characteristics

Temperature	0 to 60°C (Operating) 40 to 80°C (Storage)
Humidity	0 to 95% (Non-condensing)

Physical Characteristics

Height	2.585 in
Width	14.080 in
Depth	8.30 in
Weight	5.5 lbs (Net) 6.5 lbs (Shipping)

Indicators

Power	Green, Steady
Wireside Active	Green, Steady
Fiberside Active	Green, Steady

Power 110/220 Vac ±15% Plug Selectable, surge protected
24 Vdc ±15% (Unprotected) 8.0 Watts

Data Rate

Modbus Plus	1.0 MBaud
S908 bus	1.544 MBaud

Distance (Wire)

S908 Bus	Full 35 dB
Modbus Plus	1.5 K ft, W/O Repeaters 6.0 K ft, With Repeaters

Optical

Wavelength	820 nm
Connectors	AT&T type ST

Optical Budget

50/125 µ	-6.5 dB
62.5/125 µ	-11.0 dB
100/140 µ	-16.5 dB

Optical Launch Power

50/125 µ	-12.8 to -19.8 dBm
62.5/125 µ	-10.0 to -16.0 dBm
100/140 µ	-3.5 to -10.5 dBm

Receiver Sensitivity -30 dBm

Dynamic Range 20 dB

Pulse Width Distortion Tolerance

Modbus Plus	200 ns
S908 Bus	130 ns

Contributions

Wireside S908 & MB+	40 ns
Fiber	3.0 ns/km*
Repeaters	10.0 ns/Box

*62.5 µ Fiber only

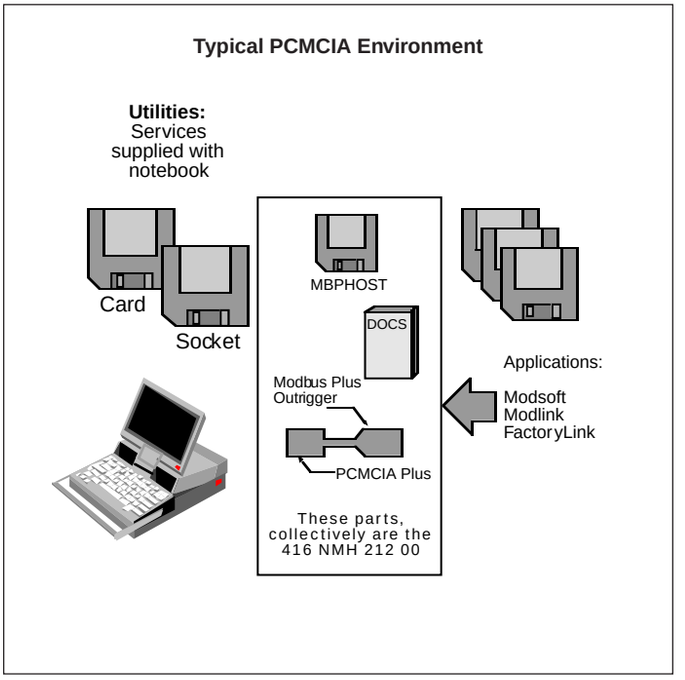
Distance vs Number of Repeaters

Cable Type	Max. Point to Point km	Jitter ns/km	Number of Modbus Repeaters 2	3	4	5	6	7	8	9	10	11	12	13	14	15	
50/125	2	3	2	4	6	8	10	12	14	16	18	17	13	10	7	3	Max
62.5/125	3	5	3	6	9	12	15	18	16	14	12	10	8	6	4	2	Cable
100/140	3	7.5	3	6	9	12	13	12	11	9	8	7	5	4	3	1	Dist

Cable Type	Max. Point to Point km	Jitter ns/km	# of S908 Repeaters 2	3	4	5	6	7	8	
50/125	2	3	2	4	6	8	10	7	3	Max
62.5/125	3	5	3	6	9	8	6	4	2	Cable
100/140	3	7.5	3	6	7	5	4	3	1	Dist

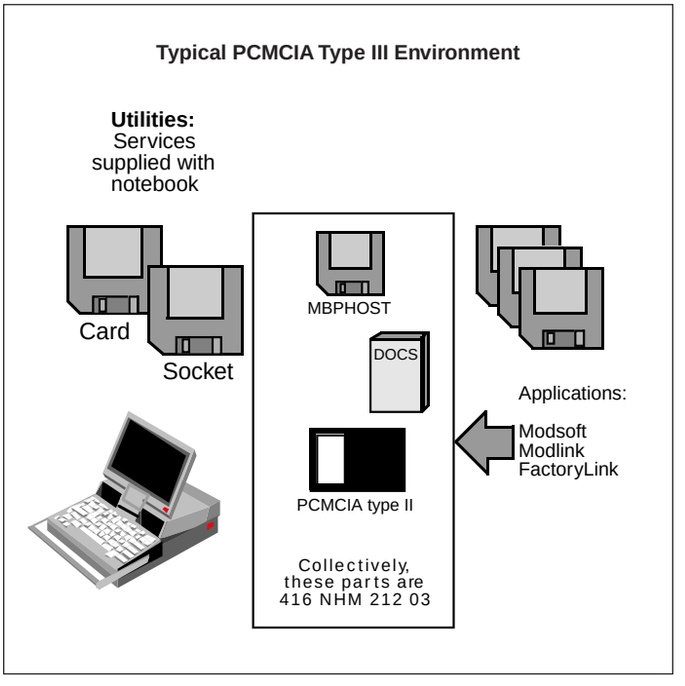
Modbus Plus Type II PCMCIA Card

The Modbus Plus PCMCIA Card allows users to connect laptop and notebook computers to the Modbus Plus network. Very similar to the SA85 card for IBM compatible desktop PCs, this card is very small and lightweight, complementary to the size and weight of the latest laptop and notebook computers. MBPHOST software and documentation is linked to the hardware.



Modbus Plus Type III PCMCIA Card

The Modbus Plus PCMCIA type III Card allows users to connect laptop and notebook computers to the Modbus Plus network. Very similar to the SA85 card for IBM compatible desktop PCs, this card is small and has a rugged metal casing. MBPHOST software and documentation is linked to the hardware.



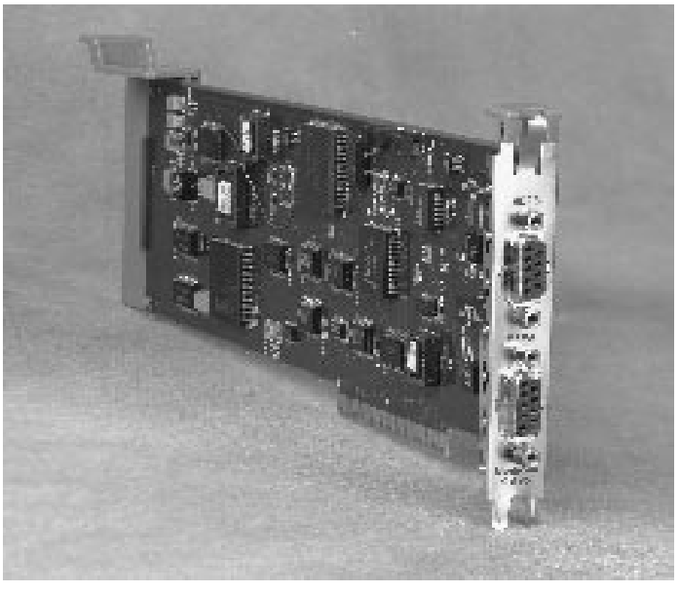
AM-SA85-002/AM-SA85-032
Modbus Plus

Redundant Network Cable Adapter

General Description

The Modicon AM-SA85-002 Modbus Plus Communications Adapter for IBM PC/AT platforms provides a variety of redundant cable and dual network configuration options with Modbus Plus.

With two modems to support alternate routing of two separate cable systems for the same network, the SA85-002 can detect a cable fault and automatically switch to the backup cable without disrupting communications (see Figure 1). For those critical applications that require redundant cabling for the communications system, the SA85-002 delivers statistical information automatically and continuously to maintenance personnel regarding the health of each cable system. The Modicon seamless SA85 redundancy solution ensures maximum system uptime.



Features and Benefits

- Full functionality Modbus Plus Redundant Communications Adapter that plugs into a single slot of an IBM AT-bus personal computer or compatible.
- Can be configured for redundant and/or dual network systems simultaneously for higher production counts and greater uptime (see Figure 2).
- Provides health test every message.
- Real-time fault detection and report to statistics.
- Provides fault information to all nodes.
- Available kit includes 32 bit Windows™ software drivers.

Specifications

Part Number	AM-SA85-002/AM-SA85-032
Description	Modbus Plus Network adapter for redundant cable version for IBM/XT, AT and compatibles. AM-SA85-032 also includes 32 bit Windows drivers.
Deliverables	
Hardware	AM-SA85-002
Software	SA85.SYS, NETBIOS Device Driver NETLIB.C, Library of C Routines TESTXX.C, example of NETLIB C use MBPSTAT.EXE, Diagnostics Software
Additional Software	SW-LNET-I95, SW-LNET-INT, in AM-SA85-032 SW-WVDD-I95, SW-WVDD-INT
Software drivers for Windows 95 and Windows NT.	
Documentation	GM-MBPL-001 Modbus Plus Network Planning and Installation Guide GM-HBDS-001 IBM Host Based Devices Users Guide
Selectable Options	
Station Address	DIP Switch, 01-64 Settings
Memory Space	Range, C0000 FF800; Default D0000
Physical Characteristics	
Size	XT Half Slot Card, 5.2" x 4.2"
Weight (AM-SA85-002)	Net, 1.2 lbs. Shipping, 2.0 Ibs.
Environmental	
Temperature	
Operating	0-60° C
Humidity	0-95% non condensing
RFI/EMI Susceptibility	MIL-STD-461B CS02-Conducted RS03-Radiated

Figure 1. Redundant Cable Single Network

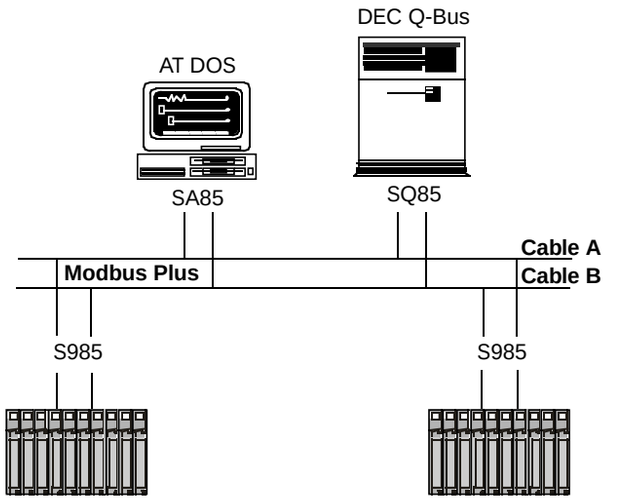
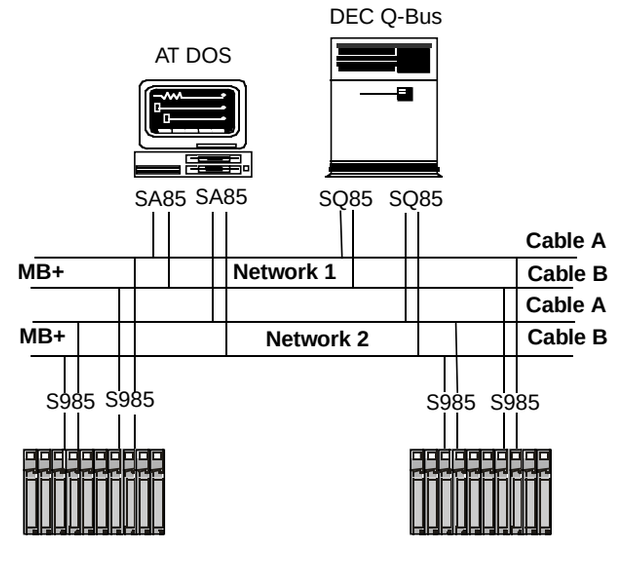


Figure 2. Redundant Cable Dual Networks



ModConnect SV85 Adapter Overview

The VME Technology and Support Package provides a qualified VME ModConnect Partner the required resources necessary to develop and support a device driver specifically for the operating system running on their VMEbus systems. The package includes hardware, software, and Modicon engineering support. The VME ModConnect Partner is expected to set up and maintain a development environment to develop the driver and support it on a long term basis.

The SV85 Developer's Manual contains a full description of how the VME products operate and communicate with the VMEbus and Modbus Plus. The manual was created to provide developers the information required to design, develop, and support a low level device driver.

Topics in the Manual Include:

- Description of the Modbus Plus network
- Definition of Message Routing
- VME hardware description
- SV85 installation and operation
- Modbus Plus software description and how to access the dual ported RAM
- Modbus Plus Frame Format description
- Sample Dual Port RAM program
- Crash Code listing

VME Technology and Support Package

The ModConnect Partner must purchase the package as configured.

AS-TECH-V86

Quantity	Part Number	Description
1	AM-SA85-002	IBM PC MB+ Dual Channel
1	AM-SV85-002	Assy Dual Channel MB+
2	AS-MBKT-085	MB+ Line Connector Kit
2	AS-MBKT-185	MB+ Terminator Connector Kit
1	AS-MBPL-001	MB+ Connector Tool
1	PC-E984-385	984 CPU 16K Mem 1XMB MB+
1	SW-MSID-9SA	ModSoft 1 Install
1	490NAA27101	TP-PVC Jacketed Reel

In addition:
1 VME Developer's Manual
Agreement to provide 80-hours of technical support

SV85 Design Support and Review

ModConnect Partners receive 80 hours of technical support from the Engineering Support Group. Technical support consists of phone consultation and/or meetings. This support helps the Partner proceed quickly through the design and development phases of driver development and testing.

ModConnect SV85 Modbus Plus Network Adapter for VMEbus Systems*

The SV85 Modbus Plus Network Adapter allows VMEbus computer products to interface directly to the Modbus Plus network. The adapter functions as a peer node on the network, passing tokens in its assigned network address sequence. The host application communicates through the adapter to other nodes, sending and receiving message transactions containing data and statistics.

The SV85 product consists of a dual-height single width VMEbus PC board including on-board firmware. In addition to the Modbus Plus port, three general purpose RS-232 channels are included.

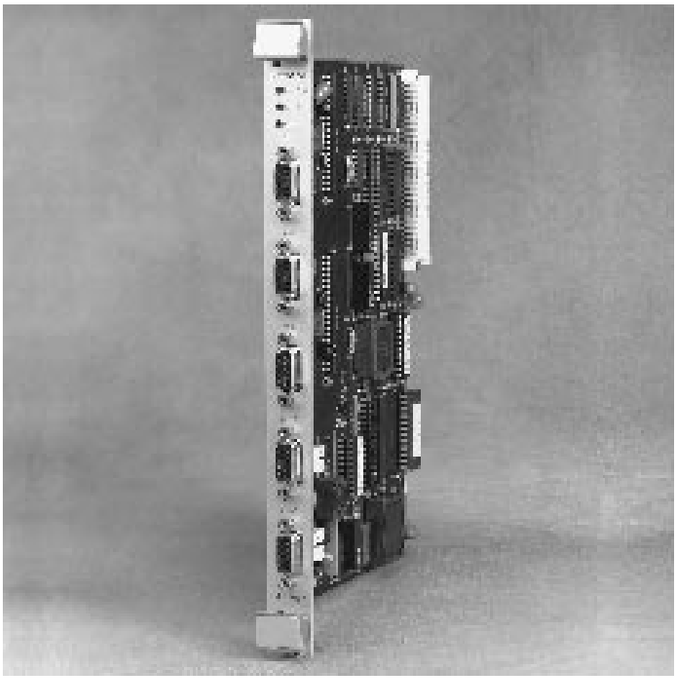
VMEbus products, hardware, software, and operating systems, are offered by numerous manufacturers, OEMs, and system integrators. End users of these systems have the flexibility to mix and match suitable components to provide custom solutions for control and plant operations applications. Because there are so many options available, including operating systems, the SV85 Modbus Plus Adapter, is shipped without operating system device drivers.

The SV85 Modbus Plus Adapter is sold principally to OEMs, system houses, system integrators, selected distributors and end-users who are qualified to develop and support a low level Modbus Plus device driver for the SV85 in their VMEbus system. The qualifications are:

- Acceptance into ModConnect Partners Program
- Qualified Engineering/Technical/Support Staff
- Investment of the VME Technology and Support Package
- Training

*** Note: You must be a ModConnect Partner to purchase this item. Please see Appendix for details on becoming a ModConnect Partner.**

ModConnect SV85-002 Modbus Plus Network Adapter for VMEbus Systems



SV85 General Description

The AM-SV85-002 is a Modbus Plus Communications Adapter that plugs into a single slot of a VMEbus based system. The Modbus Plus network is a high speed peer-to-peer communications network designed to connect Modicon high performance 984 controller family, plant, floor computers and other factory floor devices. Typical applications for the Modbus Plus network are data acquisition and monitoring, program upload and download, programming across the network and interfacing to manufacturing applications running on plant computer systems.

The Modicon SV85 Network Adapter is the hardware used to connect VMEbus based host systems to the Modbus Plus network. The board plugs into the VME backplane and is attached to the network by means of a special nine pin connector. The medium of the network is a single twisted shielded pair cable up to 1500 ft. long, supporting up to 32 nodes on a network without repeaters; up to 6000 ft. and 64 nodes with repeaters.

SV85 Technical Specifications

Part Number	
AM-SV85-002*	**SV85 Modbus Plus redundant cable adapter board for VMEbus platforms**

You must be a ModConnect Partner to purchase this item. Please see Appendix for details on becoming a ModConnect Partner.

Physical

Hardware	SV85 interface board	
Software	None	
Documentation	Provided with technology and support package, which must be purchased separately	
Selectable Options	Station address (DIP switches)	
	Control and status register configuration	
	VMEbus interrupt vector	
	3 RS-232 port configuration	
Indicators	Modbus Plus Active, standard flash codes	
	Comm error port A	
	Comm error port B	
Power	+5.0 Vdc, 1.0 amp (Max)	
Size	6U form factor	
Weight	Net .85 lbs	
	Shipping 2.15 lbs	
Architecture	Supported:	
	A24 or A16, DE08 Slave	
	Modbus Plus, 1KB shared dual port RAM	
	VMEbus interrupt interface	
	Address pipelining	
	Address broadcast-no response	
	Supervisory and user mode	
	Unsupported:	
	DMA	
	Read-modify-write	
	Block transfer commands	
SV85 Boards per Housing	No limit	
Ports	One redundant Modbus Plus, Three Modbus	

Environmental

Temperature	Operating	0-60°C
	Storage	-40 to +85°C
	Humidity	10 to 90%, non-condensing

* Redundant cable

32 bit Software Libraries for Modicon Host Interface Adapters

These Windows 95 / Windows NT Drivers and NETLIB/NetBIOS Libraries allow you to use Concept, Modsoft, Modlink, Factorylink software, and other 16 and 32-bit application software packages to communicate with Modicon Programmable Controllers, and other products supporting Modbus Plus communications.

Features

Compatible with current modicon hardware and software products:

- Runs existing 16-bit NETLIB/NetBIOS applications (Concept, Modsoft, Modlink, MBPSTAT and Factorylink) on Windows 95 or NT.
- Concept, Modsoft, Modlink, Factorylink, MBPSTAT run *without* modification, no code changes are required.
- Supports all Modbus Plus communication function calls.
- Multiple Modbus Plus Network Adapters are supported (limited by available slots).
- Supports both polled and interrupt modes of operation.

Provides Easy Integration to Personal Computer Platform Technologies:

- Existing 16-bit and 32-bit NETLIB/NetBIOS applications can run in both local and distributed environments.
- Transparent Client/Server network connectivity.
- Qualified for Intel processors.

Modbus Plus Host Interface Adapters Supported

AM-SA85-000	AM-0984-AT0	416 NHM 212 00
AM-SA85-002	AM-0984-AT2	416 NHM 212 03
	AM-0984-AT4	

Description	Part Numbers	
	Windows 95	**Windows NT**
32 bit Windows MB+ Drivers *		
Local NETLIB Library	SW-LNET-I95	SW-LNET-INT
Remote NETLIB Library	SW-RNET-I95	SW-RNET-INT
Virtual Device Driver	SW-WVDD-I95	SW-WVDD-INT
Subscription Service (one additional year)		
Local NETLIB Library	SR-LNET-I95	SR-LNET-INT
Remote NETLIB Library	SR-RNET-I95	SR-RNET-INT
Virtual Device Driver	SR-WVDD-I95	SR-WVDD-INT

* Includes free updates for 90 day period.

The Local and Remote NETLIB libraries, and Virtual Device Driver provide seamless integration when utilizing ModConnect Series Host Interface Adapters with NETLIB/NetBIOS compatible software. The libraries are compatible with Windows 95 and Windows NT, running on computer platforms utilizing the Intel platforms.

The Local NETLIB Library

The 32-bit Local NETLIB library provides connectivity between Modbus Plus Network Adapter Cards and Windows 95 (or Windows NT) based NETLIB compatible applications. Existing 16-bit applications, when recompiled and linked with the 32-bit NETLIB library will yield 32-bit performance. The library can also be used for new applications that are targeted for Windows 95 (or Windows NT). See Example 1., Stand-alone Configuration for more details.

The Virtual Device Driver

Used in conjunction with the Local or Remote NETLIB Libraries, allows existing 16-bit NETLIB/NetBIOS compatible software (i.e. Concept, Modsoft, Modlink, MBPSTAT, Factorylink) to operate successfully *without modification* under Windows 95. See Example 1., Stand-alone Configuration for more details.

The Remote NETLIB Library

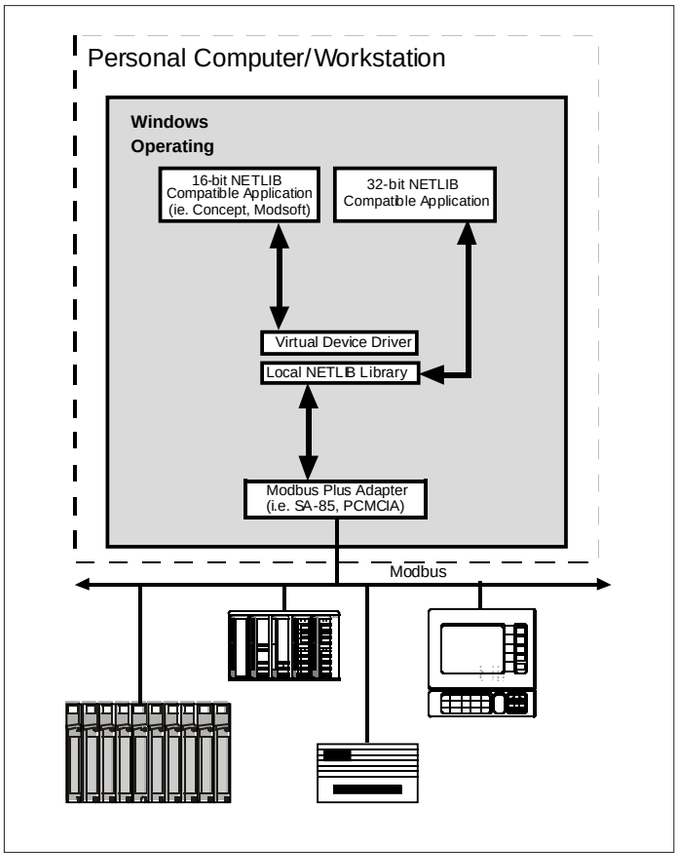
The 32-bit Remote NETLIB library provides complete NETLIB features to a networked “client node”. Networked users have full access to all NETLIB features via all Windows 95 supported networks. This includes the ability to operate Modsoft from the client node, to view and edit programs remotely, and access Modicon PLCs and Modbus Plus networks connected to the “server node” computers*. See Example 2., Client / Server Configuration for more details.

* Note: The Server Node must be equipped with Windows NT in a client/server configuration.

Example 1. Stand-alone Configuration

Required Components:

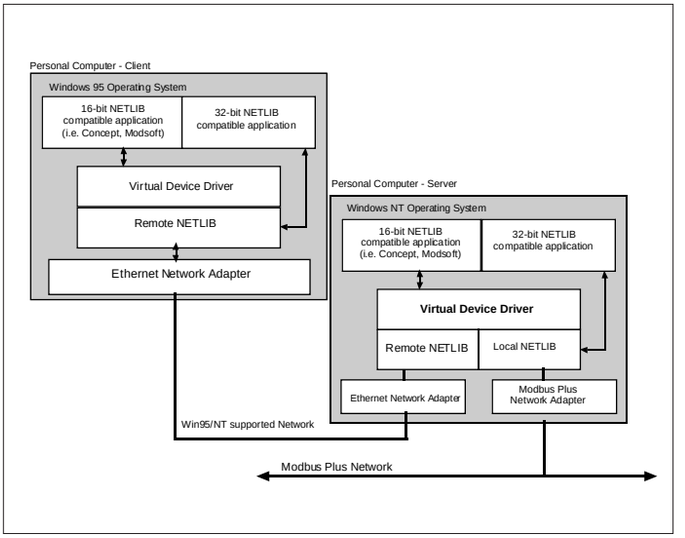
Quantity	Description
1	Concept, Modsoft, Modlink, MBPSTAT, Factorylink or other 16-bit (or 32-bit) application software.
1	Local NETLIB (SW-LNET-I95)
1	Virtual Device Driver (SW-WVDD-I95)
1	Windows 95 Operating System Software (purchased from Microsoft)
1	ModConnect Modbus Plus Host Interface Adapter (i.e. SA-85, PCMCIA).



Example 2. Client / Server Configuration

Required Components:

Quantity	Description
2	Concept, Modsoft, Modlink, Factorylink or other 16-bit (or 32-bit) Application Software.
1	Local NETLIB for Server (SW-LNET-INT)
1	Virtual Device Driver Server (SW-WVDD-INT)
1	Virtual Device Driver Client (SW-WVDD-I95)
1	Remote NETLIB Library for Server (SW-RNET-INT)
1	Remote NETLIB Library for Client (SW-RNET-I95)
1	Windows NT Operating System Software for Server (purchased from Microsoft)
1	Windows 95 Operating System Software for Client (purchased from Microsoft)
1	ModConnect MB+ Host Interface Adapter for Server (i.e. SA-85, PCMCIA)



Terminal Block I/O (TIO)

Introduction

Modicon Terminal I/O is a highly distributed I/O system that interfaces to the control system through one of several industry standard communication networks. Each I/O module is a self-contained package that includes the communication network interface, power supply, and I/O signal interface. It requires only the plug-in terminal blocks to connect with field devices.

The Terminal I/O module's compact size means it can be located in small cabinets, junction boxes, and operator consoles near field devices. The plant floor space required for the control system is reduced, the wire runs to the field devices are shorter, and the installation and start-up of the system is simplified. The modules can connect directly to 2, 3, and 4 wire sensors and actuators which eliminates the need for additional intermediate terminal blocks or marshalling strips. The resulting benefits are much simpler field connections, and a significant reduction in the installed cost when you compare the cost of a Terminal I/O system to traditional PLC I/O systems.

Each Modicon Terminal I/O module has a direct communications interface to Modicon Modbus Plus, which is the industry standard for communications in a plant floor environment. This allows the I/O to be located in drops as small as a single module and connected via a twisted pair communications cable to a wide range of PLCs, industrial controllers, and host computers.

Compared with traditional I/O systems, the Modicon Terminal I/O system offers significant savings in both system cost and installed cost, while providing all of the capabilities and ease of use of traditional I/O systems.

TIO Module Overview

Modicon Terminal I/O includes the following product installation features, designed to reduce the overall control system cost as well as simplify its installation, start-up, and maintenance.

Features

- Direct wire connection to 2, 3, & 4 wire analog and digital sensors and actuators eliminates the need for intermediate terminal blocks.
- Full set of health and status indicators for simplified local diagnostics and troubleshooting.
- Self contained unit that includes power supply, communications interface, and field terminations.
- Direct connection to several worldwide standard communcation networks .
- Compact module size reduces panel size requirements and permits mounting in small junction boxes and operator consoles.
- Distributed I/O system design allows module location near the sensors and actuators, reducing wire run length.
- Flexible system configuration allows modules to be distributed in up to 256 locations over a distance of up to 42,000 feet using the InterBus-S network.
- Removable terminal blocks are for field wiring.
- DIN rail or direct panel mounting for easy installation and removal.
- Wiring label easily identifies field wiring connections.

A typical Modicon Terminal I/O module is shown in Figure No.1 with several product features highlighted.

The Modicon Terminal I/O Family is available in a wide range of module types that interface with digital and analog field devices in all signal ranges. A partial list of Modicon Terminal I/O modules is listed in Table No. 1. Detailed information for each Terminal I/O module can be found later in this section.

User Benefits

The Modicon Terminal I/O Family was designed as a full capability I/O system that includes the following benefits for control system users.

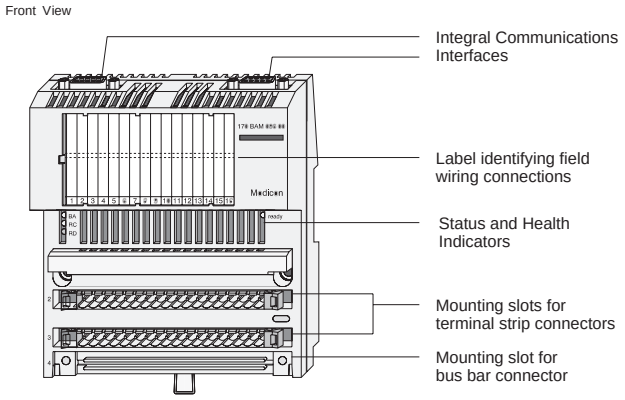
- Lower installed cost compared to traditional control systems that use either centralized or remote I/O systems.
- Easy to maintain. Existing personnel need no specialized training or equipment.
- Industry standard communications network interfaces allow users to select the control system architecture that fits their requirements.
- Highly flexible architecture means the I/O modules can be located close to field devices which reduces installation cost and time.

Table No. 1

Modbus Plus Terminal I/O Modules

Part Number	Description
170 BDI 342 00	24 Vdc 16pt In
170 BDO 342 00	24 Vdc 16pt Out
170 BDM 342 00	24 Vdc 16 In/16 Out
170 BDI 542 50	115 Vac16pt In
170 BDO 542 50	115 Vac 16pt Out

Figure No. 1



Modbus Plus

Modbus Plus is a high speed, peer-to-peer communications network. It was developed by Modicon in 1988 and designed to operate in a plant floor environment connecting devices such as PLCs, computer systems, operator stations, distributed I/O, and other control systems, as well as Modicon Terminal I/O products. There are over 120,000 nodes of Modbus Plus currently installed in industrial applications that include control products from over 80 manufacturers.

This network is simple to implement and is designed for the efficient exchange of I/O data, interlocks, status, and information between devices. Modbus Plus has a communication rate of 1.0 Mbps. Using twisted pair cable, it can connect 32 devices over a distance of 1,500 feet, and with repeaters, it can be expanded to 64 devices over distances of up to 6,000 feet. Optional fiber optic modems further expand the network distance up to 32,000 feet while offering unmatched immunity to electrical noise.

With the Modicon Modbus Plus network, Terminal I/O modules can be used with any existing Modbus Plus compatible Modicon TSX Quantum, 984, and Compact 984 controllers without additional communication interfaces or special software functions. The Terminal I/O modules can connect directly to a Modicon controller via the integral Modbus Plus communication port, or an optional Modbus Plus port expander. A typical system configuration using Modbus Plus communication and Terminal I/O is shown in Figure No. 2.

Figure No. 2. shows multiple controllers that coexist on the same Modbus Plus network with Terminal I/O modules and other devices. In this configuration, all of the controllers can read the input status from all of the Terminal I/O modules, providing an effective method for sharing field device information between controllers. Only the controller that has configured the output module in the system can write status to that module.

To configure Terminal I/O onto a Modbus Plus communication system, the easy-to-use Peer Cop function, available in the controller's programming software, can be used to assign the I/O references to the individual I/O modules. All the input data is automatically read from the input modules and all output data is written to the output modules at every scan of the controller. The Peer Cop function is a simple fill-in-the blanks display that eliminates the need for user logic programming to initiate communication between the controller and Terminal I/O modules. A Peer Cop screen display is shown in Figure No. 3.

Figure No. 2

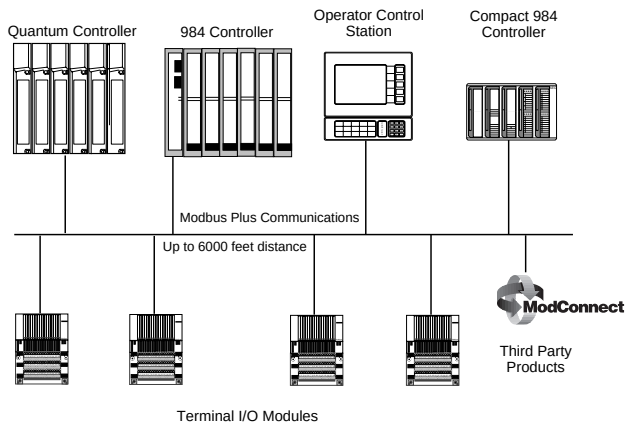
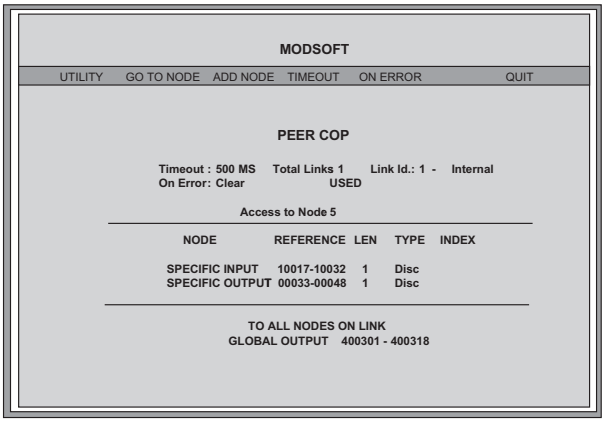


Figure No. 3



Detailed Product Information

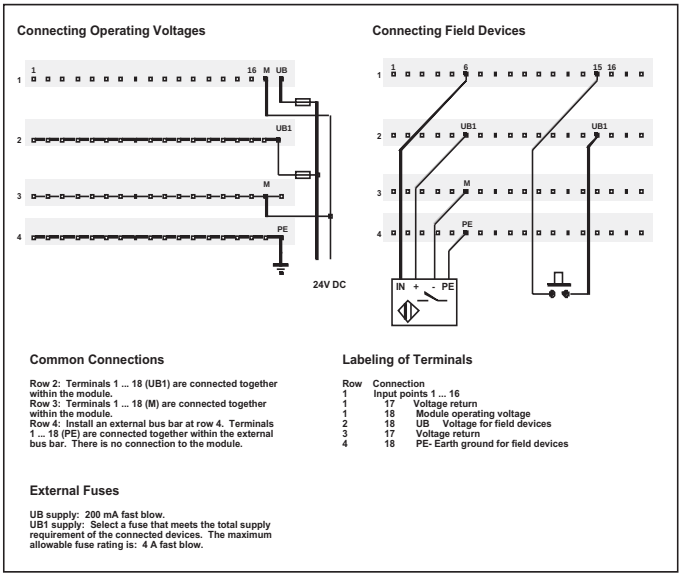
24 Vdc - 16 Point Input Module - True Low
170 BDI 342 00 - Modbus Plus

This module has 16 discrete 24 Vdc inputs for direct connection to 2 and 3 wire sensors. Model 170 BDI 342 00 module interfaces directly to the Modbus Plus network.

Specifications

Number of Input Points	16 in one group
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	-3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Nominal Input Current, each point	4.2 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Response	
OFF - ON	3 ms max
ON - OFF	3 ms max
Internal Resistance	5.6 k
Input Protection	Resistor limited
Isolation	
Point to Point	None
Group to Bus	500 Vac rms
Fault Detection	None
Fusing	
Internal	None
External	User discretion 4A max per group

Wiring Diagram - 170 BDI 342 00



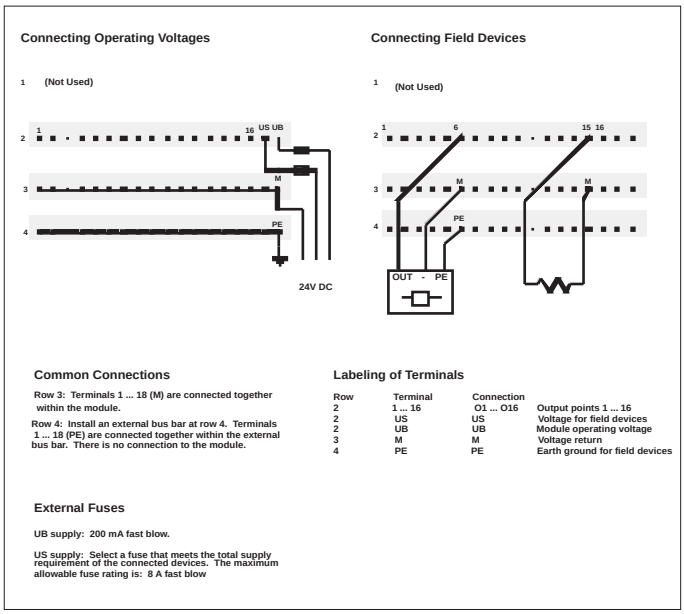
24 Vdc - 16 Point Output Module
170 BDO 342 00 - Modbus Plus

This module has 16 discrete 24 Vdc outputs for direct connection to 2, 3, and 4 wire actuators. Model 170 BDO 342 00 module interfaces directly to the Modbus Plus network.

Specifications

Number of Output Points	16 in one group
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Voltage	
Operating	20 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop/Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Per Module	8 A
OFF State Leakage/Point	0.4 mA @ 30 Vdc
Maximum Surge Current	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 µf
Response Time	
OFF - ON	1 ms max
ON - OFF	1 ms max
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation	
Group to Bus	500 Vac rms
Fault Detection	
Input	None
Output	Red LED indicator for each output
Fusing	
Input	Internal - None External - User discretion
Output	Internal - None, electronically protected External - User discretion

Wiring Diagram - 170 BDO 342 00



24 Vdc - 16 Point Input/16 Point Output Module
170 BDM 342 00 - Modbus Plus

This module has 16 discrete 24 Vdc inputs and outputs for direct connection to 2, 3, and 4 wire sensors and actuators. Model 170 BDM 342 00 interfaces directly to the Modbus Plus network.

Specifications (General)

Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation (Input and Output)	
Group to Group	None
Group to Bus	500V AC rms for 1 minute
Fault Detection	
Input	None
Output	Red LED indicator for each output - overcurrent and short circuit
Fusing	
Input	Internal - None External - User discretion
Output	Internal - None, electronically protected

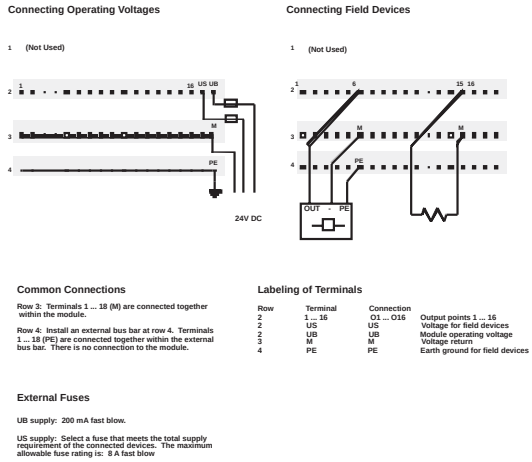
Specifications (Outputs)

Number of Output Points	16 in two 8 point groups
Voltage (Output)	
Operating (max)	19.2 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop/Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Each Group	4 A
Per Module	8 A
Off State Leakage/Point	0.4 mA @ 30 Vdc
Maximum Surge Current	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 µf
Response (Output)	
OFF - ON	1 ms max (resistive load)
ON - OFF	1 ms max (resistive load)

Specifications (Inputs)

Number of Input Points	16 in one group
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	-3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Internal Resistance (Input)	5.6 k
Response (Input)	
OFF - ON	3 ms max
ON - OFF	3 ms max

Wiring Diagram - 170 BDM 342 00



Common Connections

Row 3: Terminals 1 ... 18 (M) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

Labeling of Terminals

Row	Terminal	Connection	
2	1 ... 16	O1 ... O16	Output points 1 ... 16
2	US	US	Voltage for field devices
2	UB	UB	Module operating voltage
3	M	M	Voltage return
4	PE	PE	Earth ground for field devices

External Fuses

UB supply: 200 mA fast blow.

US supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 8 A fast blow

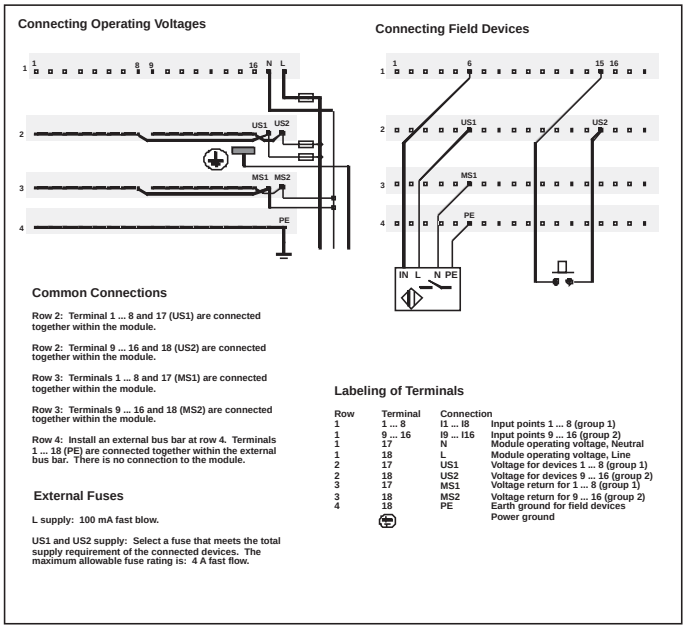
120 Vac - 16 Point Input Modules
170 BDI 542 50 - Modbus Plus

This module has 16 discrete 120 Vac inputs for direct connection to 2, 3, and 4 wire sensors. Model 170 BDI 542 50 module interfaces directly to the Modbus Plus network.

Specifications

Number of Input Points	16 in two 8 point groups	
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac	
Input Voltage and Currents Ranges		
Voltage	Guaranteed ON:	74 Vac
	Guaranteed OFF:	20 Vac
Current	Guaranteed ON:	10 mA
	Guaranteed OFF:	2 mA
Input Frequency	47 ... 63 Hz	
Absolute Maximum Input		
Continuous	132 Vac	
10 s	156 Vac	
1 cycle	200 Vac	
1.3 ms	276 Vac	
Response		
OFF - ON	Min: 4.9 ms Max: 0.75 line cycle	
ON - OFF	Min: 7.3 ms Max: 12.3 ms	
Isolation		
Input to Input	All inputs in a group must be from the same phase of line input voltage	
Group to Group	1780 Vac rms for 1 minute	
Input to Bus	1780 Vac rms for 1 minute	
Fault Detection	None	
Fusing		
Internal	None	
External	User discretion	

Wiring Diagram - 170 BDI 542 50



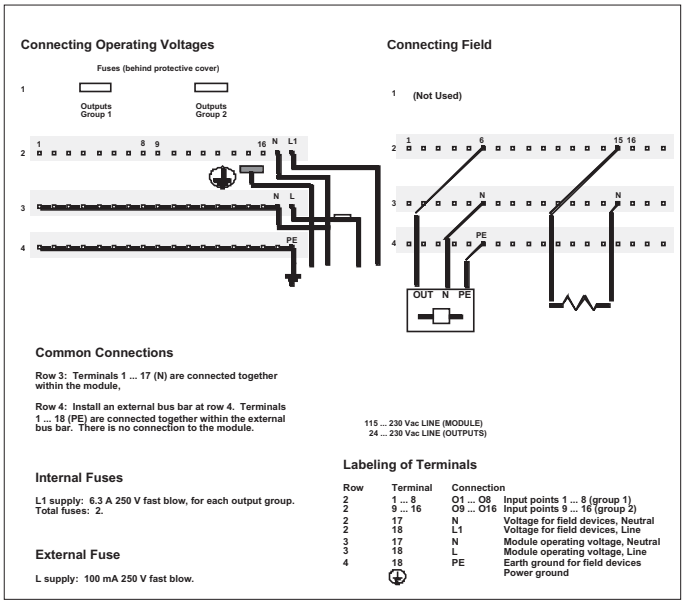
24 to 120 Vac - 16 Point Output Module
170 BDO 542 50 - Modbus Plus

This module has 16 discrete 24 to 120 Vac outputs for direct connection to 2 and 3 wire actuators. Model 170 BDO 542 50 module interfaces directly to the Modbus Plus network.

Specifications

Number of Output Points	16 in two 8 point groups
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac
Output Voltage (rms)	
Working	20.4 ... 253 Vac
Absolute Maximum	300 Vac for 10 s 400 Vac for 1 cycle
Frequency	47 ... 63 Hz
ON State Drop/Point	1.5 Vac max.
Minimum Load Current (rms)	10 mA
Maximum Load Current (rms)	
Each Point	0.5 A continuous, 20.4 ... 253 Vac rms
Per Module	8 A continuous
Off State Leakage/Point (max)	3.75 mA
Surge Current Maximum (rms)	
One Cycle	15 A per point
Two Cycles	10 A per point
Three Cycles	5 A per point
Applied DV/DT	400 V/µs
Commutative DV/DT	5 V/µs
Response	
OFF - ON	0.50 of one line cycle max
ON - OFF	0.50 of one line cycle max
Output Protection (internal)	RC snubber suppression
Isolation (rms)	
Output to Output	300 Vac for 1 minute
Output to Bus	1780 for 1 minute
Fusing	
Internal	One 6.3 A 250 V fuse per group
External	User discretion

Wiring Diagram - 170 BDO 542 50



Accessories

Part Number	Description
170 XTS 001 00	Screw Terminals (3 per package) for field wiring
170 XTS 006 00	Screw Terminal Bus Bar (1 row) for grounds and shields
170 XTS 005 00	Screw Terminal Bus Bar (2 rows) for grounds and shields
170 XTS 004 00	Screw Terminal Bus Bar (3 rows) for grounds and shields
170 XTS 002 00	Spring Terminals (3 per package) for field wiring
170 XTS 007 00	Spring Terminal Bus Bar (1 row) for grounds and shields
170 XTS 008 00	Spring Terminal Bus Bar (2 rows) for grounds and shields
170 XTS 003 00	Spring Terminal Bus Bar (3 rows) for grounds and shields
170 BDM 090 00	Pre-wiring Module (module shell)
170 XCP 100 00	Additional Wiring Label Kit (1 included with each module)
170 XCP 200 00	Accessory Kit (coding keys, mounting screws, jumpers)
170 BSM 016 00	Simulator: Input Switches
890 USE 104 00	Hardware Reference Guide